

SPY TRAP - *by* J. EDGAR HOOVER

POPULAR MECHANICS

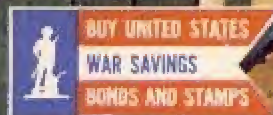
MAGAZINE

WRITE WHAT YOU CAN UNDERSTAND

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SEE PAGE 7

25 CHRISTMAS GIFTS YOU CAN MAKE

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WITH
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D I V I S I O N O F G E N E R A L M O T O R S

The Rubber Plant

**with roots
two miles deep**



THE MAKING OF synthetic rubber involves among other things the exact control of gas mixtures of great complexity. Formerly the analysis of some gases required several days of painstaking laboratory work, and in some cases a complete analysis was impossible.

Westinghouse scientists—working in close collaboration with engineers of leading oil and chemical companies—have perfected an electronic “chemist” which is an important addition to the present methods of analysis.

With the improved technique and apparatus now available, the time required for accurately making some of these analyses has been reduced to an hour or less!

An amazing electronic device . . . known as the mass spectrometer . . . not only improves the accuracy of the synthetic rubber process, but frees hundreds of skilled chemists from tedious but important production testing in these vital plants.

The mass spectrometer analyzes gases by sorting the molecules—according to their mass—in (roughly) the same way that a cream separator sorts out the cream from whole milk.

Let's say we want to analyze a simple gas mixture containing *one part* of oxygen and 10,000 parts of nitrogen. Here's how the mass spectrometer accomplishes this incredible feat:

- First, the gas sample is bombarded with electrons. This *ionizes* the nitrogen and oxygen mole-

cules, giving them electrical charges of their own.

These ions are then drawn by electrical force into a curved vacuum tube. Here, ions of different molecular weights whizz around *different curved paths*—depending upon their reaction to a powerful electromagnet surrounding the tube.

The heavier oxygen ions follow a straighter path than the lighter nitrogen ions and are directed through a tiny exit slit onto a plate where they give up their electrical charge. The amount of this charge, amplified and recorded by sensitive electrical instruments, is an accurate measure of the *quantity of oxygen* in the mixture.

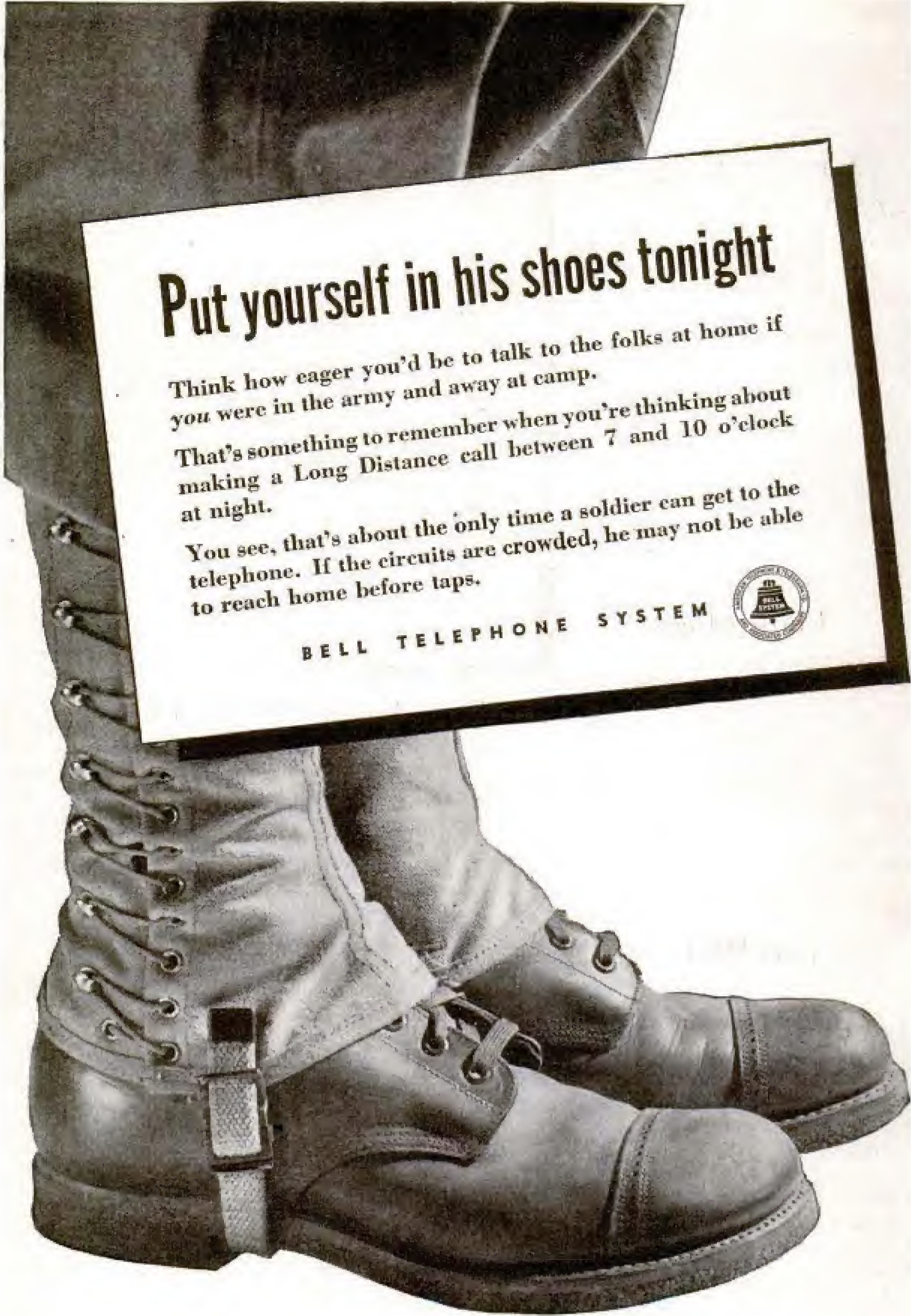
The starting voltage is then changed to allow the nitrogen ions to pass through the same exit slit—thus measuring the *quantity of nitrogen*. This same principle applies to the analysis of complex hydro-carbon mixtures.

The development of the mass spectrometer . . . for the quick, accurate analysis of butadiene . . . is a typical example of the way Westinghouse “know how” in electronics is tackling the wartime problems of industry in an effort to speed victory.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pennsylvania.

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Put yourself in his shoes tonight

Think how eager you'd be to talk to the folks at home if you were in the army and away at camp.

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You see, that's about the only time a soldier can get to the telephone. If the circuits are crowded, he may not be able to reach home before taps.

BELL TELEPHONE SYSTEM



Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

December, 1943

Vol. 80, No. 6

Next Month

WHAT this country needs, says Charles F. Kettering, is not 300 postwar planning groups but 130 million. Every man ought to be his own. In "Blueprint for Tomorrow," a January feature, the "boss" of research for General Motors and chairman of the National Inventors Council explodes the popular notion that research and science are sacred. Invention, he says, is 99.99 percent failure and if we want more inventors, we must teach people how to fail intelligently. Friends have told Mr. Kettering we'll never get more than 5 percent thermal efficiency out of autos. His answer is: "We have 95 percent left to work on."

Plant Magic

WITH half a teaspoonful of chemicals you can play tricks on nature that Luther Burbank never achieved. Spray a hormone on your apple trees and the fruit will cling to the branches until it is ripe, eliminating windfall losses. Similar plant magic creates giant flowers, fruits and vegetables, brings sick plants to life, produces seedless tomatoes. An article next month tells what is being done with hormones and vitamins.

'Hoppers With Teeth

IT WAS dusk as the Nazi U-boat broke the surface of the Gulf of Mexico to pick up an American freighter in its periscope sights. But overhead appeared a tiny plane to challenge it, and the Germans crash dived. Next month a story of the Civil Air Patrol reveals that its "grasshopper" planes, in 20 million miles of flying, have made more than 150 attacks at sea.

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How Japan Will Be Defeated

THERE are five courses of action in the Pacific by which the Allies can defeat Japan. Capt. Frederick L. Oliver, U. S. Navy (retired), outlines them in a vivid discussion of our strategy, written for the January issue. Giving his own estimate of the situation, Captain Oliver says our primary task is to destroy the Japanese fleet piecemeal or in a major engagement, with the ultimate objective of striking at the Japanese islands. Already, he says, Japan has lost more than 500 ships, including most of its carriers, several battleships, more than 40 cruisers, and destroyers by the dozens.

Photos Without Film

HAVE you tried buying photographic film lately? You're lucky if you get what you want. The army and navy come first. But in these days of film shortages you might try photographing on sensitized paper. It is not as sensitive to light and requires greater exposures—but enlarging paper is unrationed, it's inexpensive, and produces quite satisfactory pictures. Read how to do it in an article next month.

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★ What can I do to help get my car started in cold weather?
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★ What can I do to stop the accumulation of dirt, sludge, gum and other contamination in my crank-case?
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★ What can I do to increase the efficiency and life of my car?

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Where no name and address appear directly under an item, the product is not believed by us to be commercially available

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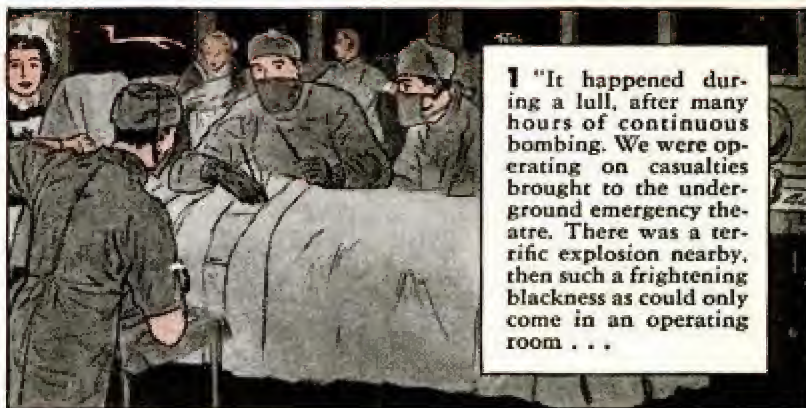
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BLACKOUT IN THE OPERATING ROOM!

A true story of the war, as told by SISTER ISABEL NIXON, Head Nurse of St. Thomas Hospital, London, to a war correspondent.

The centuries-old London hospital has three distinctions. It is London's most bombed hospital (undoubtedly because of its proximity to the Houses of Parliament just across the Thames). It has not during this war lost an air raid victim. And it was the home of Florence Nightingale. Headnurses still wear the same uniform and laced-edged frilled bonnets pioneer Nightingale wore during the Crimean campaign.



1 "It happened during a lull, after many hours of continuous bombing. We were operating on casualties brought to the underground emergency theatre. There was a terrific explosion nearby, then such a frightening blackness as could only come in an operating room . . .



2 "That single stray bomb had shattered the two outside electric plants. It would take time to rig up the emergency plant. Meanwhile we had a victim on the operating table, in danger of bleeding to death. I told all the nurses and medical students to get their flashlights . . .



3 "We grouped around the table, giving the surgeon the light he needed to save his patient . . . Because of the highly inflammable ether we couldn't have used a hurricane lamp. This was one of many, many cases where only flashlights with proper batteries could have been used to save life."

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IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described in order to avoid possible liability for patent infringement.



How Do You Use The Most Important Hours of Your Day?

The most important—and they can be the most profitable, too. Men—ordinary men in ordinary circumstances—have had returns of as high as \$5, \$10, \$25, even in exceptional cases \$50 per hour for these hours.

They are the hours of your leisure time—usually spent in recreation or odds and ends.

These can be your growth hours, the time when through training you can prepare for more efficient service on the job or for the job ahead. During your working hours, you are usually buried in routine details, growing slowly if at all. But in these spare hours, your mind can reach out to absorb the experience of others, to learn the principles and methods behind your job and behind your field. The next day on the job, you will find yourself using something of what you learned the night before to the benefit of your job and the pleasure of your boss.

Interestingly enough, this spare time study can be fascinating recreation, not drudgery. And the few minutes spent this way tone up the remaining hours of your leisure

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WHAT CAN THEY MEAN TO YOU?

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If you are 18 but under 27 . . . go to your nearest Aviation Cadet Examining Board . . . see if you can qualify as an Aviation Cadet. If you are in the Army, you may apply through your commanding officer.

If you are under 18 (whether or not you have joined the Air Corps Enlisted Reserve) . . . see your local Civil Air Patrol officers about taking C. A. P. Cadet training —also see your High School adviser about taking H. S. Victory Corps prescribed courses.

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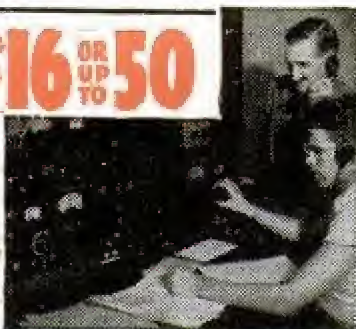
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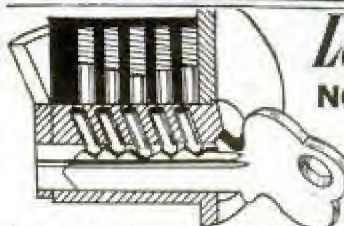
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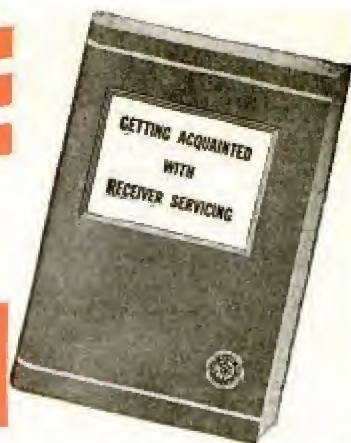
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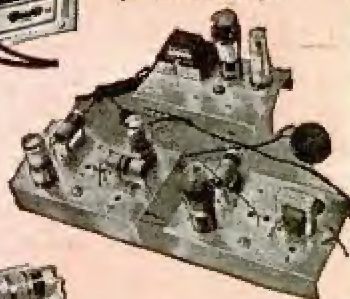
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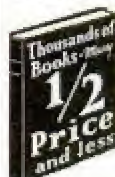
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State of Illinois, County of Cook, ss.
Before me a Notary Public in and for the State and county aforesaid, personally appeared H. H. Windsor, Jr., who, having been duly sworn according to law, deposes and says that he is the Editor of the Popular Mechanics Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to-wit: First, That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Mechanics Company, 200 East Ontario St., Chicago, Ill.; Editor, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill.; Managing Editor, H. W. Magee, 200 East Ontario St., Chicago, Ill.; Business Manager, Willis S. Brown, 200 East Ontario St., Chicago, Ill. Second, That the owner is (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given; if owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Mechanics Company, 200 East Ontario St., Chicago, Ill.; L. H. Windsor, 200 East Ontario St., Chicago, Ill.; H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill.; H. W. Windsor, Jr., Trustee, The First National Bank of Chicago, Trustee. Third, That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. Fourth, That the two paragraphs next above, giving the names of the stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stock holder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other persons, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. H. H. Windsor, Jr., Editor. Sworn to and subscribed before me the 24th day of September, 1943. Viola M. Flanagan, Notary Public. (My commission expires May 11, 1944.)

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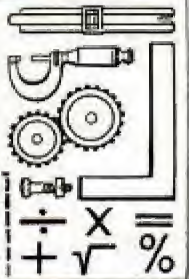
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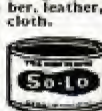
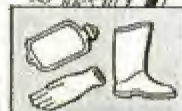
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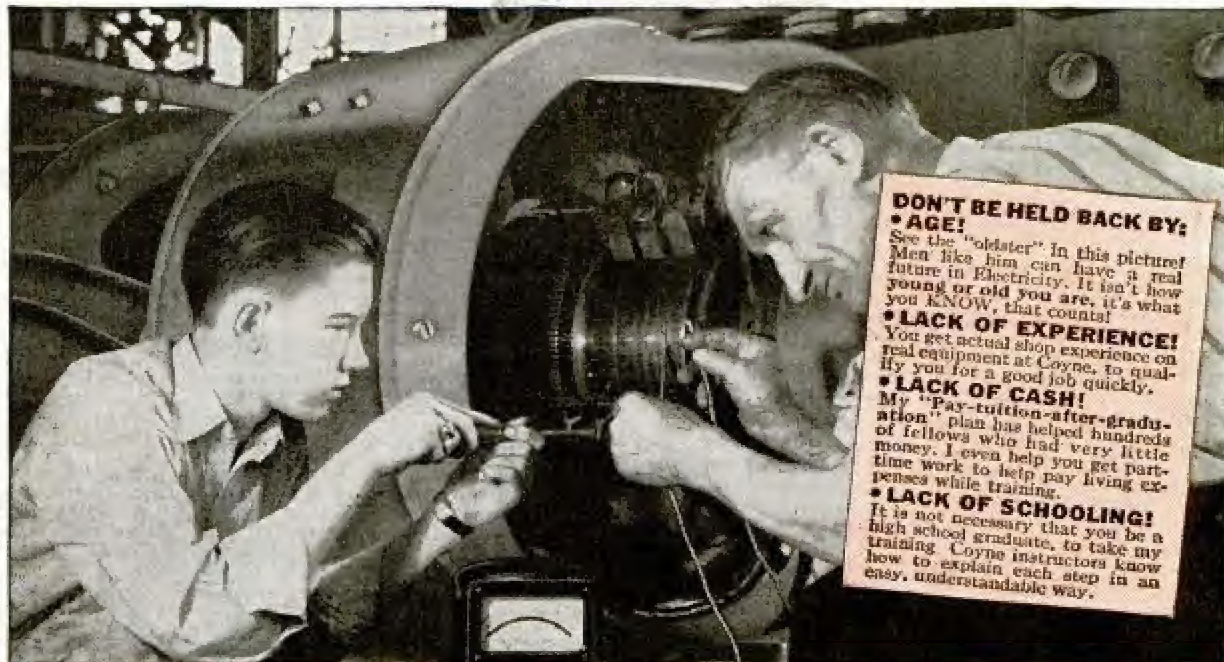
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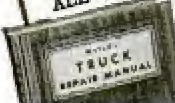
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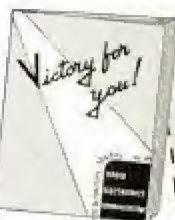
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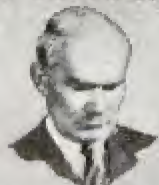
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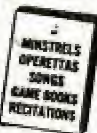
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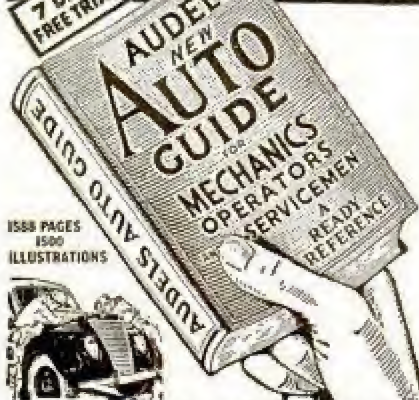
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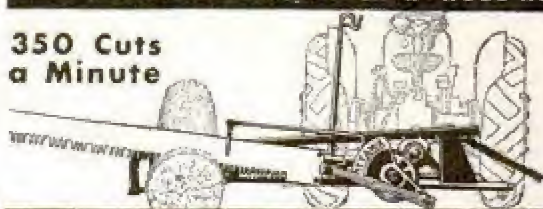
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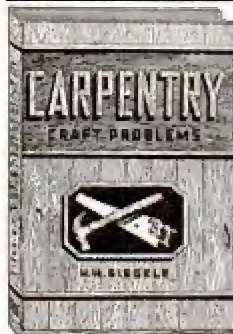


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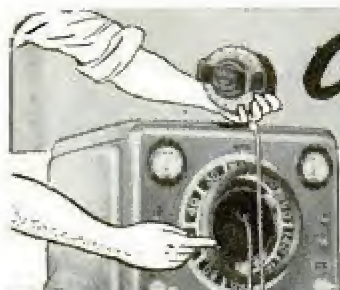
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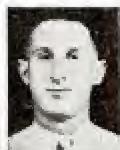


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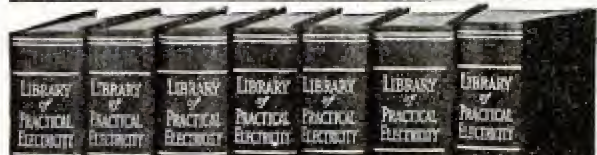
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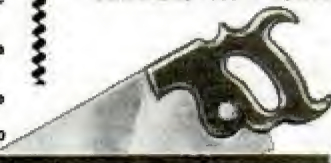
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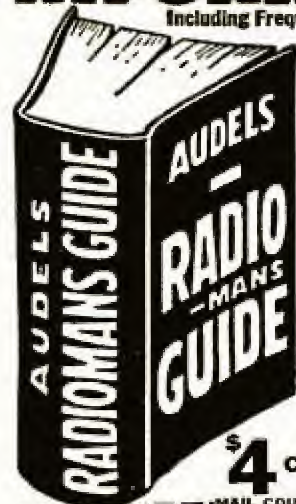
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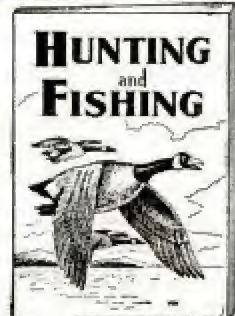
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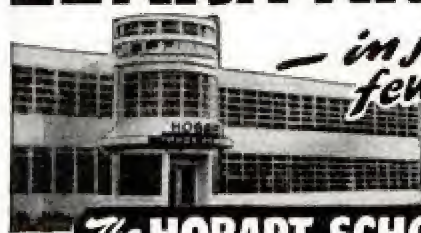
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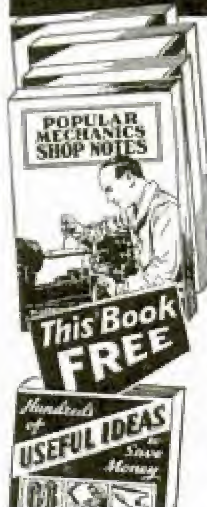
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"This house—I wouldn't swap a shingle off its roof for any other house on earth. This little valley, with the pond down in the hollow at the back, is the spot I like best in all the world.

"And they're mine. I own 'em. Nobody can take 'em away from me.

"I've got a little money coming in, regularly. Not much—but enough. And I tell you, when you can go to bed every night with nothing on your mind except the fun you're going to have tomorrow—that's as near Heaven as a man gets on this earth!

"It wasn't always so.

"Back in '43—that was our second year of war, when we were really getting into it—I needed cash. Taxes were tough,

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BACKGROUND FOR PRECISION

In seeking to conquer infinite space, the aircraft engine builder must master the infinitesimal.

He must achieve exquisite precision in the motor he makes.

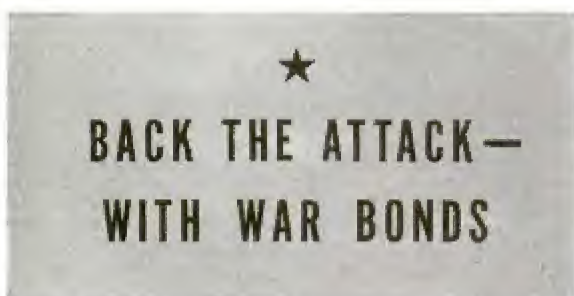
Such precision has been a habit with Allison for many years. It has been our assignment to handle production problems requiring special skills.

For here is wide experience in fine design.

Here is deep understanding of the strength and structure of metals.

Here is meticulous machining.

These attributes today, combined with General Motors' faculty for mass manufacture, are giving substance to the purpose of our very being —our aim to build the finest aircraft engine the world knows.



POWERED BY ALLISON P-38 — *Lightning* • P-39 — *Airacobra* • P-40 — *Warhawk* • P-51 — *Mustang*

A large, detailed illustration of an Allison V-12 liquid-cooled aircraft engine. The engine is shown from a front-three-quarter perspective, highlighting its complex components like the cylinder heads, intake manifold, and cooling system. In the background, several aircraft are depicted in flight against a dark, cloudy sky. The Allison logo, featuring the word "Allison" in a script font with a star above the 'i', is positioned in the lower right corner of the engine illustration. Below the logo, the words "DIVISION OF" are printed in a small, sans-serif font. To the right of the Allison logo is the General Motors logo, which consists of the letters "GM" in a bold, sans-serif font inside a square border, with the words "GENERAL MOTORS" printed in a smaller, sans-serif font below it.

LIQUID-COOLED AIRCRAFT ENGINES

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

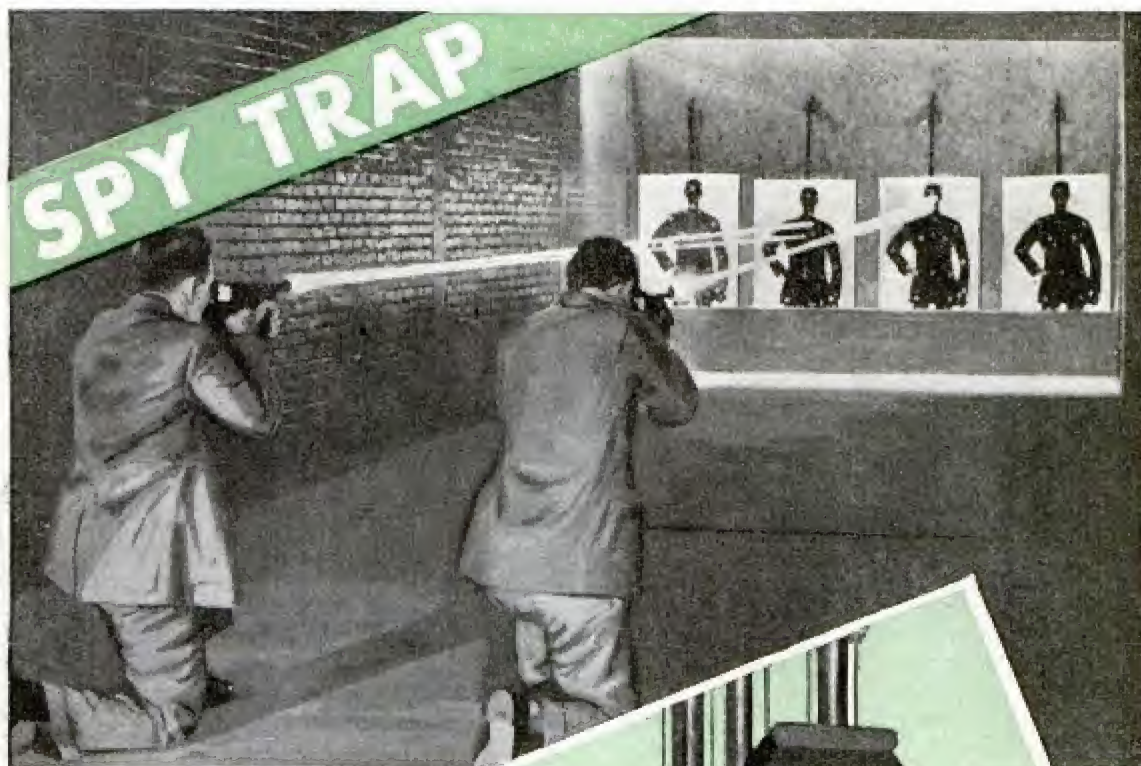
WRITTEN SO YOU CAN UNDERSTAND IT

21 569

Vol. 80

DECEMBER, 1943

No. 6



Washington, D. C.
By J. Edgar Hoover

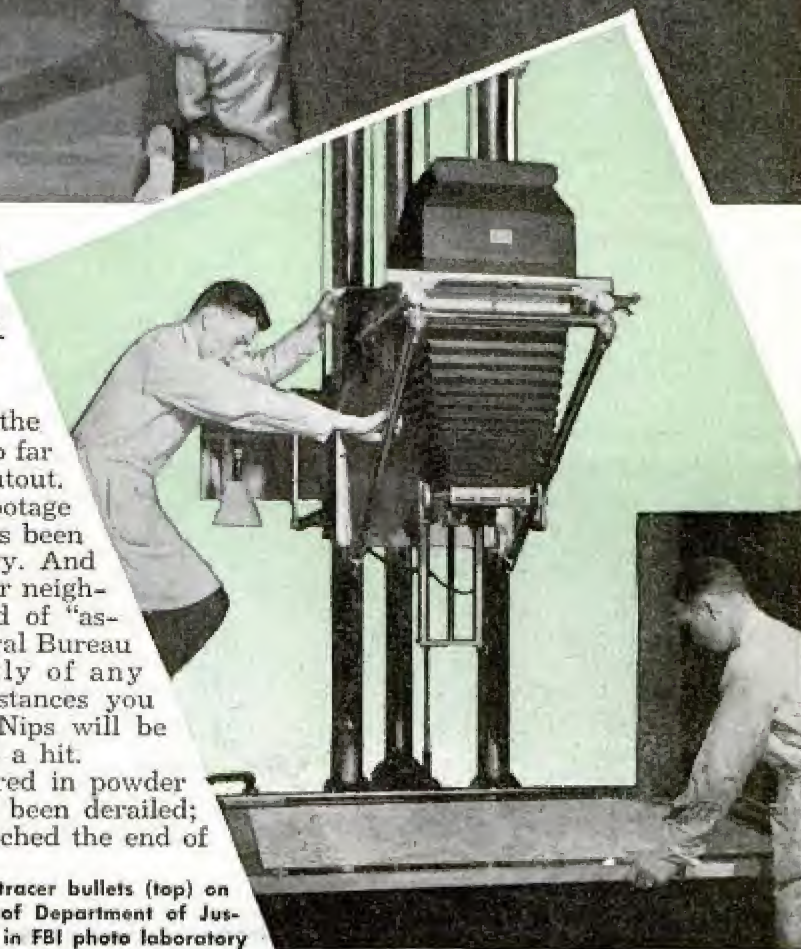
Director,
Federal Bureau of Investigation

As Told to Roderick M. Grant

THE war is going into the seventh inning, and so far the FBI has scored a shutout.

Not one instance of sabotage by paid enemy agents has been perpetrated in this country. And if you and your next door neighbor keep up your record of "assists," notifying the Federal Bureau of Investigation promptly of any really suspicious circumstances you observe, the Nazis and Nips will be retiring one day without a hit.

Explosions have occurred in powder plants, yes. Trains have been derailed; bombing planes have reached the end of



G-men practice regularly with tracer bullets (top) on target range in the basement of Department of Justice. Right, huge enlarger used in FBI photo laboratory

DECEMBER, 1943



A ballistics specialist examines the interior of a suspect weapon with helixometer in technical laboratory

the production line with electric and control lines severed. In fact the FBI has investigated more than 10,371 cases of suspected sabotage since Jan. 1, 1940. But every suspicious act investigated has been traced to carelessness, industrial accident, or occasionally to sabotage by workmen disgruntled or sympathetic with an enemy people. For violating our wartime sabotage statutes, 466 persons have been convicted in state and federal courts through FBI activity. The professional saboteur, however, has tried but has gotten nowhere.

Fortunately for America, the G-Men who won their renown in the gang-busting and kidnaping 'thirties were put into the antiespionage business by presidential order in 1939. By the time Japan was ready to make its near-fatal stab at Hawaii the FBI had a card index of undesirable

Nazi, Jap and Italian residents and on Dec. 7, 1941, the G-Men began sweeping them up on a 24-hour basis. Surveys had been made of 2,286 war factories, the loyalty of their workmen established and methods of guarding vulnerable plants determined.

Before the war was six months old the FBI had broken two Nazi spy rings and convicted nearly 1,500 violators of the National Defense laws. While in 1939 there were just 832 Special Agents on the Bureau staff, today there are more than 4,600 Agents among a total FBI personnel of 13,000. In the years before 1939, cases involving the national defense averaged only 35 a year. Last year 218,734 investigations were made in national security matters.

The work of the FBI is closely coordinated today with that of the Military and Naval Intelligence services, and every week

Tracer bullets pour into a shack from rapid-fire guns during night firearms training on the outdoor range



the key men of these three units hold joint conferences at Washington and regional offices throughout the country.

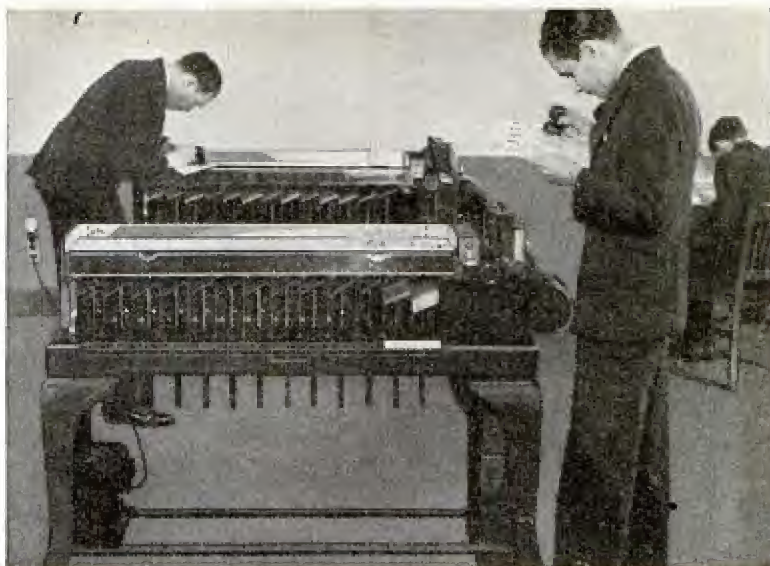
Most famous of the spy rings smashed were the Duquesne gang, of whom 33 were sentenced to prison, and the eight saboteurs who were brought to Long Island and Florida beaches by submarine and put ashore, highly trained and fully equipped for careers of sabotage in our aluminum and magnesium plants.

The careers of these eight lasted ten days or less. They scattered around the country, only to be caught up quickly in the FBI net—how, the FBI has yet to reveal. They were tried before a military commission, six were executed, the other two imprisoned for life and 30 years.

But the interesting fact is that when these eight Nazis came to America straight from the German High Command's school for saboteurs, the FBI drew from its secret files a complete docket on each man. Each had been investigated and catalogued during his previous residence in the United States and his biography filed for reference when each left for Germany.

Cracking down on Axis agents, stopping sabotage before it starts, is probably the most important item on the FBI agenda right now, but it is only one item. Generally speaking, the Bureau of Investigation handles any federal case not specifically assigned by Congress to some other branch. The Internal Revenue Bureau, for example, has its own investigating staff. Among other duties, the FBI investigates federal bank robberies, antitrust law violations, kidnappings and extortions involving interstate angles or use of the mails, interstate thefts and white slavery, bankruptcy violations, and many more categories of crime.

A decade ago the wave of kidnappings brought enactment of the federal law governing interstate abductions, and the FBI suddenly found itself busily immersed in the Bremer and Jake Factor and Charles F. Urschel and a succes-



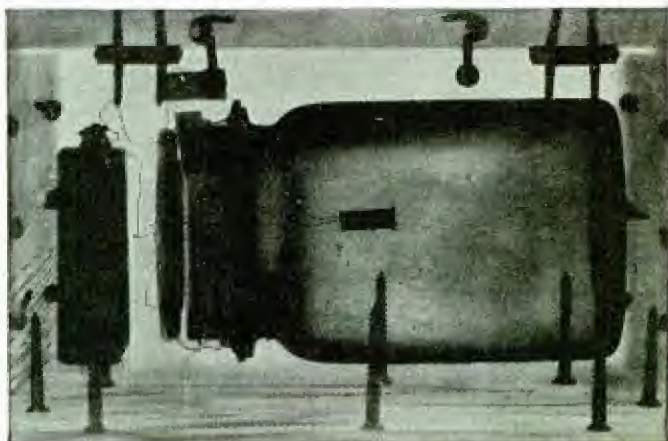
Fingerprint classification cards, punched according to characteristics, are sorted automatically by this machine in criminal identification hunt

sion of other sensational kidnaping cases.

About the same time there were the post-prohibition gang outbursts—the gun battle which ended the career of Chicago's "Baby Face" Nelson and cost the lives of two G-Men; the killing of notorious John Dillinger as he tried to fight it out with the FBI men who had surrounded him; and



Intricate and finely made time clock (above) with adapter and detonator assembled was brought here by Nazi saboteurs. Below, X-ray photograph by FBI exposes a bomb encased in box





At the training school for G-men, candidates for careers as Special Agents examine "body" and gather clues at scene of a hypothetical crime

the fatal wounding of John Hamilton in the Dillinger hideout at a northern Wisconsin resort.

For the last two years the Bureau has been kept fairly busy rounding up enemy aliens and draft dodgers. The aim is not to put draft delinquents in jail, but to see that they comply with the Selective Service Act; the investigators have located about 100,000 delinquents and induced them to register for service—making available enough men for six army divisions. More than a thousand who resisted registering were prosecuted and convicted.

Incidentally, when the Chicago gangsters, Roger Touhy and Basil Banghart, broke out of the Illinois state penitentiary a few months ago it was the FBI who recaptured them—and to make their intervention in the case legal, the G-Men seized the fugitives on the quaint but valid charge of failing to register with their local draft boards at the prison when they departed.

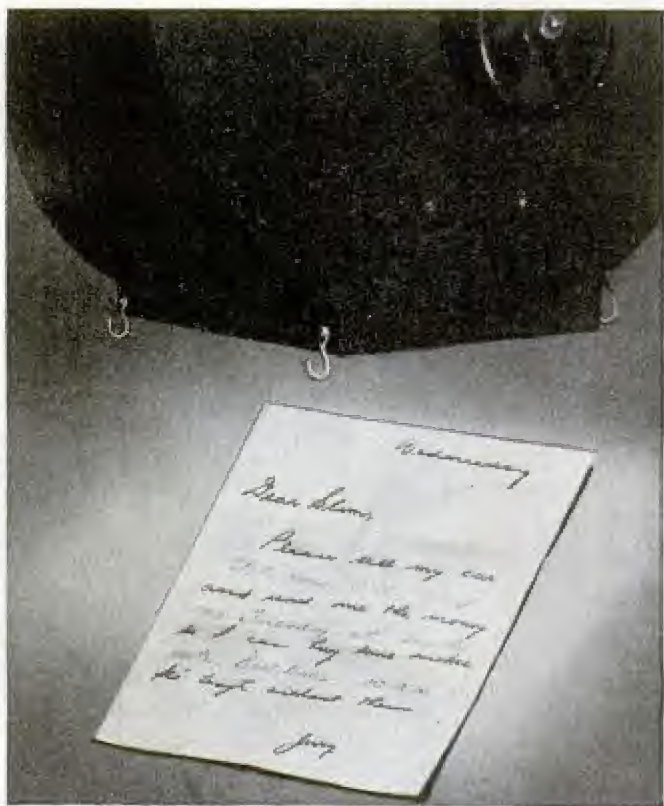
The sweeping up of dangerous aliens goes on steadily. The trap closed not long ago on Ernest Frederick Lehmitz, German-born porter in a New York restaurant, who had been gathering up details of ship cargoes and convoy sailings from seamen who roomed at his home and from talkative cus-

tomers at cafes and bars along the waterfront. Using the old technique of invisible ink, he passed his information along to mailing addresses in neutral countries. Upon arrival in these countries, his letter would be re-addressed to German espionage headquarters. These letters were intercepted and the secret messages brought out. However, there was no indication as to the real name or address of the spy. By checking the paper used in the letters, the secret ink formula and over 10,000 handwriting specimens, Lehmitz was identified by the FBI. Mild-mannered, professorial in appearance, he

amazed his neighbors by pleading guilty.

In Chicago, federal agents arrested the German-born widow of an American citizen. "I believe in Hitler," she told the officers. "I hope Germany is victorious, and I would help her in any way I could. All my love is for Germany."

Not all alien enemies are dangerous, but such as these are the potential saboteurs. Since the war broke, more than 14,400 alien



Between lines of apparently innocent letter appears secret message, exposed under ultraviolet lamp in technical laboratory

enemies have been apprehended. Contraband found in their possession included 4,222 guns, 260,000 rounds of ammunition, 2,346 rounds of dynamite, 3,900 cameras of all types, 2,625 shortwave radio receiving sets and over 1,200 swords, bayonets and similar weapons. You can admire the beautiful Japanese swords, probably made of fine American steel, in the FBI exhibit at Washington. Some were picked up in Shinto missions along the Pacific coast.

The Bureau is at home in the Department of Justice Building, and therein is the world's most completely equipped scientific laboratory for crime investigations. Highly trained photographers, micrographers, cryptologists, mineralogists, ballistic experts, chemists and others add their technical work to the master minding of the Special Agents, who are graduates of law or accounting schools and of the FBI Academy at Quantico, Va. The fingerprint identification bureau has outgrown its old quarters and moved out to fill the huge new National Guard armory. About 75,000,000 fingerprints are on file and the staff is kept fairly busy taking care of as many as 100,000 new prints received in a day. A vast department in itself is that investigating worthless checks. In "normal" times 50,000 bad checks a year are cashed, to someone's sorrow, and they all find their way to the FBI laboratory where the handwriting and style and habits of the check writers and raisers are classified and card-indexed.

Since the bombs fell on Pearl Harbor, the G-Men have been on 24-hour duty. When he is not at his office, every FBI agent must be within reach of a telephone, and he must not be more than a half hour's distance from headquarters without special leave. Ready at the Bureau for immediate shipment by air, rail or car is a trunk packed with a complete traveling laboratory for crime detection in the field. A call to National 7117 from anywhere in the world will start the crime doctors on a trail instantly, and its telephone switchboard can establish quick contact over leakproof lines to any of the 57 field division headquarters outside of Washington—or a man hunt may be started over the 20,000-mile Teletype circuit that links all the Agents.

Provided with the finest facilities the United States can assemble for them, the G-Men nevertheless rely principally on common sense deduction in solving crimes. They are simply enough smarter than the other fellow. They are forbidden to employ third-degree methods to obtain a confession. They find it is much easier to assemble the evidence, confront the suspect with it, and if he refuses to talk, leave him

(Continued to page 160)

DECEMBER, 1943

Liferaft Still Uses Body Heat To Convert Salt Water

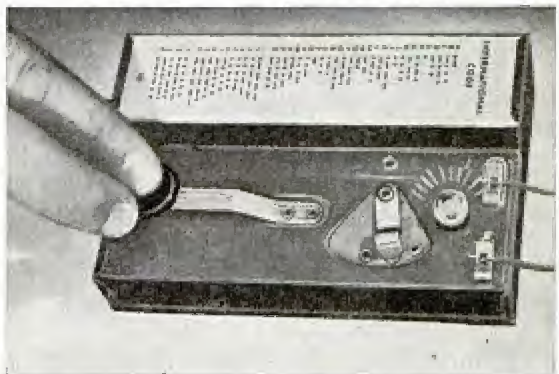


Holding small still against stomach to provide heat

An ounce of salt water can be converted to fresh water in an hour with a small still. The device, designed for use by torpedoed sailors or fliers forced down at sea, is held against the stomach to use body heat in the process. The condenser is trailed in the cold water of the ocean. The still was developed at the University of Minnesota.

Practice "Bug" Teaches Code By Click, Buzz and Flash

Beginners are learning to send and receive telegraph code with a twin sending and receiving set, battery-operated, which transmits signals in three ways. Its key will tap out letters with the ordinary click used in telegraph transmission, with the buzz characteristic of wireless signals or with the flash of a tiny light bulb. With the two units are provided an instruction sheet for learning code and a set of miniature Western Union telegram blanks.

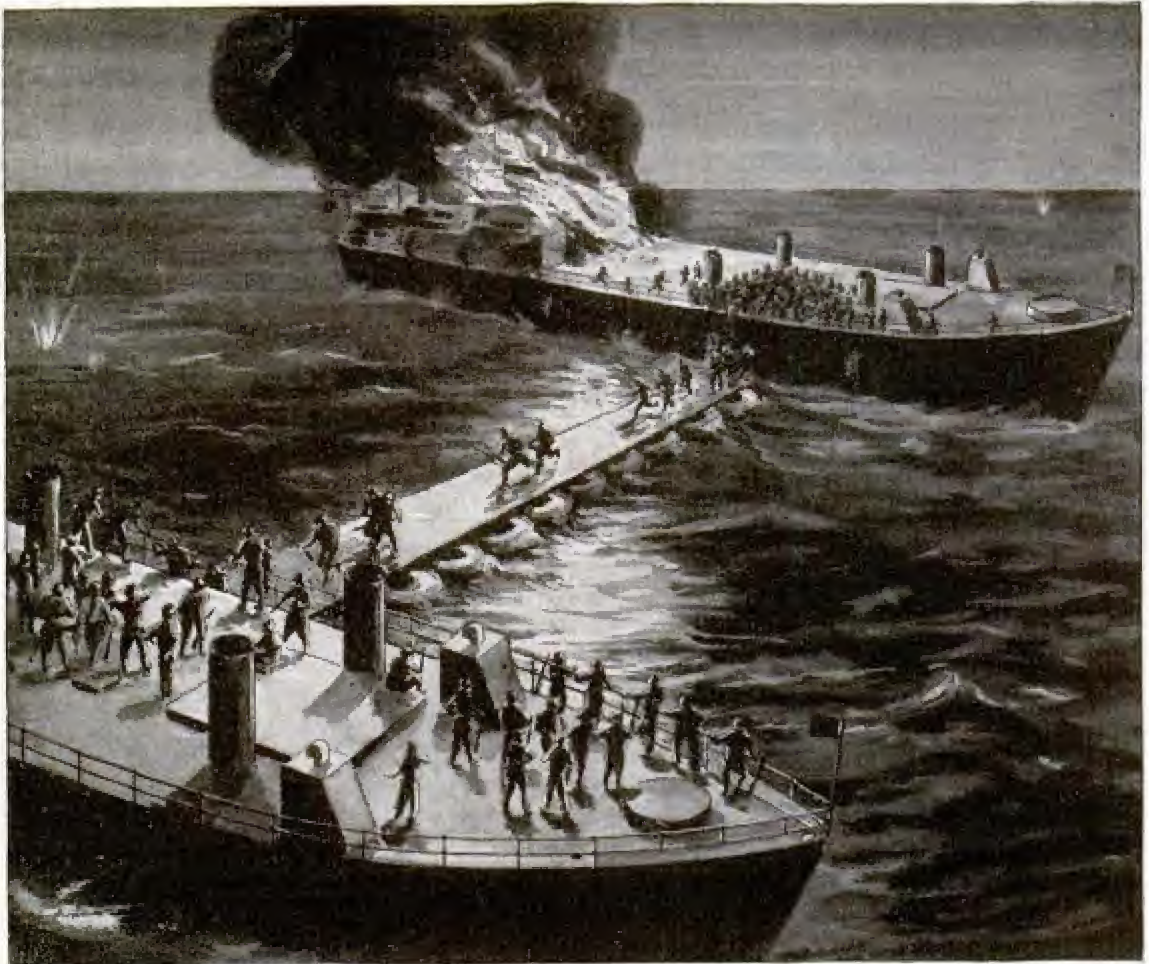


Tapping out message by "blinker" light with the key

Radio Warehouse Market
362 Wacker Ave.
Akron, Ohio.

77635
Mrs. Carl Solberg & Maurice B. Visser
University of Minnesota
Minneapolis, Minn.

Pontoon Bridge Saves Men From Flaming Ship



Men from bombed troop-carrying ship escape over pontoon bridge quickly rigged up at sea by Navy Seabees

Men of the Navy's Seabees (construction battalions), with split-second decision, rescued troops from a flaming ship during the invasion of Sicily by rigging a pontoon bridge at sea. Aboard an LST vessel (landing ship for tanks), the Seabees were behind the troop carrying ship when bombs struck the latter craft, setting it afire. The Seabee ship was trailing a pontoon bridge. As the troopship burst into flames, the

Seabees maneuvered their bridge against the side of the burning vessel, and minutes later the troops from it were racing across the seagoing bridge, to safety on the Seabee ship. Not only did the Seabees perform their assigned task of getting war material ashore, but they also accomplished this rescue job, salvaged 100 small boats, saved 90 men from another bombed ship and captured an Italian flag.

7660

Precision Bombing to Set Stage for "Bloodless" Invasion

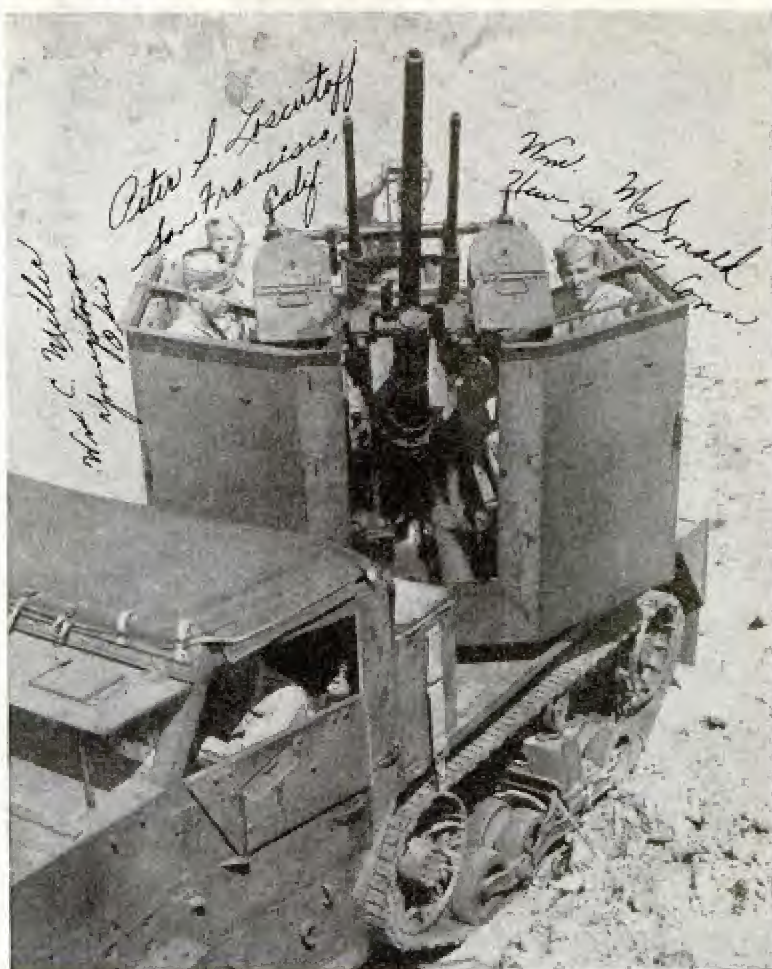
Strategic bombing of vital enemy targets, such as aircraft factories, flying fields, and munition plants, will save thousands of lives in the final stages of the war, according to Brig. Gen. E. P. Sorensen, assistant chief of the Army Air Force Staff Intelligence. Four phases of a scientific pre-invasion bombing program outlined by the general are: No. 1—shallow penetration to reduce air defense by wrecking factories manufacturing warplanes, and other targets. No. 2—deeper penetration

to blast industrial targets which will mark the beginning of internal decay. No. 3—knocking the heart out of enemy production by shattering such targets as chemical plants, synthetic oil plants, transportation systems. No. 4—final destruction of all production units and any original targets that may have been rebuilt. After the fourth phase, according to Gen. Sorensen, enemy territory will be ripe for invasion with a minimum of casualties inflicted by ground forces.

Camp Edwards, Mass 7532

Hit-Run Ack-Ack Guns Mounted on Half-Track

Multiple anti-aircraft guns, mounted in an armored cupola on the rear of a half-track, are an army answer to strafing enemy planes. The hit-and-run ack-ack mounts are sufficiently mobile to be used to protect moving troops. Their use also introduces the element of surprise in the defense, since the attackers, returning for a second run over a target, may find themselves under fire from an unsuspected point—the guns can be moved between attacks. Both crews and machines established good records in fighting in Africa. Guns of varying caliber mounted in the armored turret enable the gunners to down planes at a variety of altitudes.



Enemy planes swooping in to strafe marching Yanks find our troops take own anti-aircraft guns along with them on a half-track

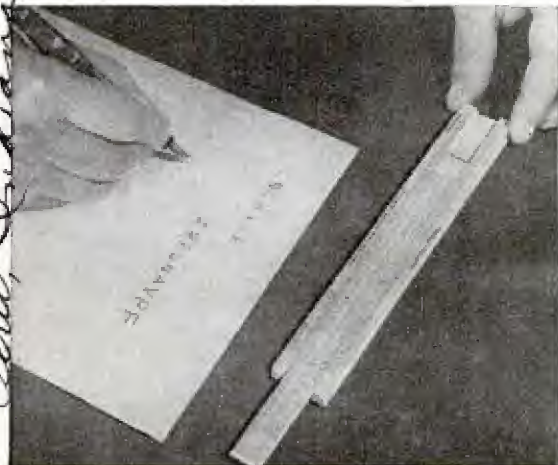
7583"Slide Rule" for Coding Messages Also Deciphers Them

Secret codes by the score are devised by a "slide rule" that substitutes one letter for another or a number for a letter. Messages are coded and deciphered quickly with the device. With a row of letters at the top,

numerals at the bottom, and a sliding center section, it is operated on the principle of a slide rule.

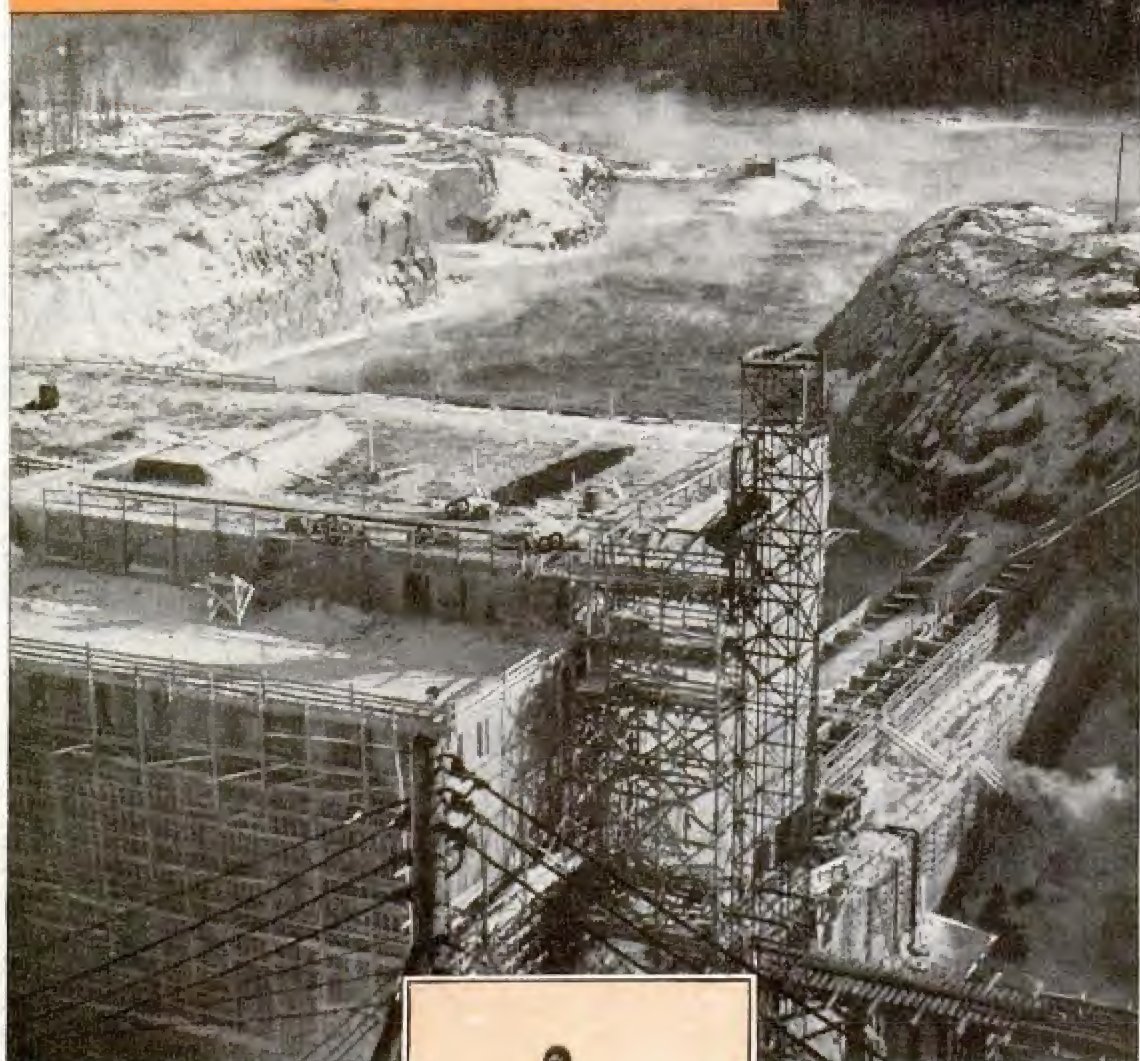
734Crushed Jewels in Navy Decks Provide Nonskid Flooring

American Navy gun crews walk on virtual carpets of semi-precious stones. Garnets, pulverized into coarse grains, form the abrasive part of a non-skid covering for decks and gun emplacements. They are used in "Dektred," a product of the Good-year Tire & Rubber Co., and are mixed with a plastic or synthetic resin binder that will adhere to the vessel's smooth steel surface. This finish can be applied with a trowel or spray gun, and it bristles with abrasive points of the pulverized jewels, which form a safe footing even when the deck is spray-washed or covered with oil. A substitute for garnets is alundum, made by fusing aluminum oxide in an electric furnace. A number of precious stones are crystals of natural aluminum oxide.



Rule substitutes one letter for another or a number

GIANT *of the* NORTH



DEEP in the wilds of northern Quebec, thousands of hardy Canadians are battling the early winter snow, ice and rain to put the finishing touches on one of the world's greatest power plants, the Shipshaw hydroelectric development, destined to produce aluminum. So important to the war effort is this giant of the north woods that for nearly two years its construction was a closely held military secret.

This little-known Goliath of the wilderness will produce 50 percent more power than Uncle Sam's famous Boulder Dam. Yet, with more than 10,000 men employed day and night at peak periods, it will be completed twice as fast, despite the fact



Planes need aluminum; to make aluminum requires power. Above, a view of Canada's solution, the huge Shipshaw power project in the wilderness. Left, linesman positions an insulator at 50 below

that it is constructed in what was recently a bleak, uninhabited, roadless expanse of rocky woodlands, with freezing weather the greater part of the year.

Much of the construction has taken place out of doors when the thermometer

dropped to 50 degrees below zero.

Twelve giant turbogenerators will produce about 1,500,000 horsepower. Using this current, the nearby aluminum plants will contribute nearly half a million tons of aluminum ingot during 1944 to the United



Solid rock was removed for the tailrace—often it was frozen as well (above). Right, pouring four-ton load of concrete. Below, welding tunnel liner for end of tube carrying water in 208-foot drop to powerhouse

Nations' war effort. This is more than the United States and Canada together produced only a few years ago, and what it means in the war is indicated by the fact that 90 percent of the weight of the average military plane and 50 percent of the weight of the average airplane engine are made up of aluminum.

To build a canal that would divert the rushing water of the icy Saguenay River, to make a dam to hold it; to burrow six tunnels leading the flow of the turbogenerators and to build the power plant itself, with the tail race to send the torrent back to the original river bed, 7,000,000 cubic yards of earth were removed.

Enough concrete was brought in to construct a four-foot highway that would stretch from Montreal to London.

A railroad, freight yards and all, was installed for the project, as well as bunkhouses for thousands of men. In fact, a virtual city was constructed in the wilder-





Inside one of six great tubes leading to powerhouse, members of ice crew use pneumatic hammer on ice so diggers, muckers, blasters can get to work

ness with theater, recreation halls, fire department and huge cooking and mess halls. These were made necessary by the fact that the site is hundreds of miles from the nearest important city in a district frequented for centuries only by Indian and white trappers and hunters and their prey.

The reason the project was undertaken in such a desolate and faraway spot is that the Saguenay river at this point drops about the height of a 17-story building within a few miles, and this tumbling tide of "white coal" was one of the best undeveloped potential sources of power on the continent. Also, there was an abundant store of bauxite, the mineral from which aluminum is produced, within practical transportation distance.

The United States government advanced about \$68,500,000 to the Aluminum Company of Canada to help finance the Shipshaw project. In this power development, in two smaller ones on the same river and in an aluminum plant nearby, the corporation has invested around \$250,000,000.

The result is that the Shipshaw aluminum setup will produce nearly as much of the valuable metal as all of the Axis facilities combined, further swinging the balance of power in the air to the allies during the coming months.

Concrete-lined tunnel carries flow of water to one of Shipshaw's turbogenerators

Some 200,000 tons of the metal produced will be shipped into the United States. The rest will be converted into products and parts by Canada and England.

To take advantage of the 208-foot drop of the water, it was first necessary to construct truck roads, the railroad, supply depots and living quarters for the men, and to move tons upon tons of materials, machinery and supplies to the desolate site. When the giant crew was recruited from all parts of Canada, work was begun blasting a canal to turn the water into a natural depression which could be stopped by a super-dam, one of the largest ever built.

When the dam was completed, the plug was blown out of the river end of the canal and a lake was formed.

Meanwhile, other crews had been busy blasting six 30-foot tunnels, each about 400 feet long which would drop the water from the lake above and send it rushing through whirling turbogenerators to create the electric power.

The six tubes were blasted out of solid



rock for most of their 400-foot length. Although each tube was to be thirty feet wide, it was necessary to blast for a width up to fifty feet in places to remove infirm rock which might later collapse and crush the concrete shells with which the tubes were lined.

As fast as one crew blasted and another removed the debris, a third followed into each opening, erecting a circular steel-reinforced wooden lining. When this lining was completed, another gang came in with the concrete. This was transported into the tubes in buckets holding four tons each.

The concrete was forced at high pressure through holes in the circular wooden form to make a casing ranging from a minimum of three feet thick to a maximum of twenty where the rock had been blasted away because of infirmity.

Separate crews of specialists were kept busy even between the usual ten-hour shifts chipping away newly formed ice with pneumatic hammers along the tunnels so that the incoming workers could labor without hindrance from the thick coating of white which formed continually in below-zero weather. These ice crews were occupied steadily throughout most of the fall, winter and spring months loosening the hold which ice quickly took on equipment and materials.

If a dump car loaded with debris, or a hod full of concrete were not emptied



Here's what 50 tons of dynamite, going up at once, look like. Blast removed 18,000 yards of rock, and was felt 50 miles away

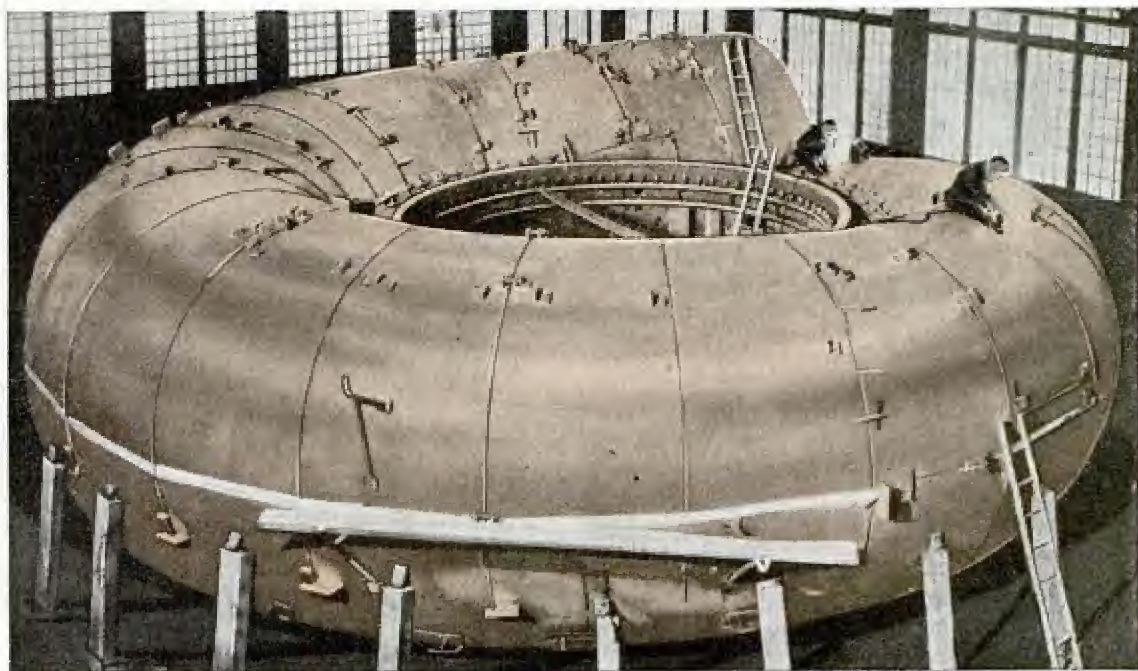
quickly, a crew would be needed to use picks to break the icy mass in the vehicle.

As each of the six tubes, slanting downward from the depression which was to be converted into a lake, came out of the rock above the powerhouse at the lower level, a thirty-foot steel lining, which had been fabricated hundreds of miles away and transported in sections, was welded together and pushed into each tube.

The tunnel of rock, therefore, at this point became a tube of steel. After a short space, this steel tube was divided in two

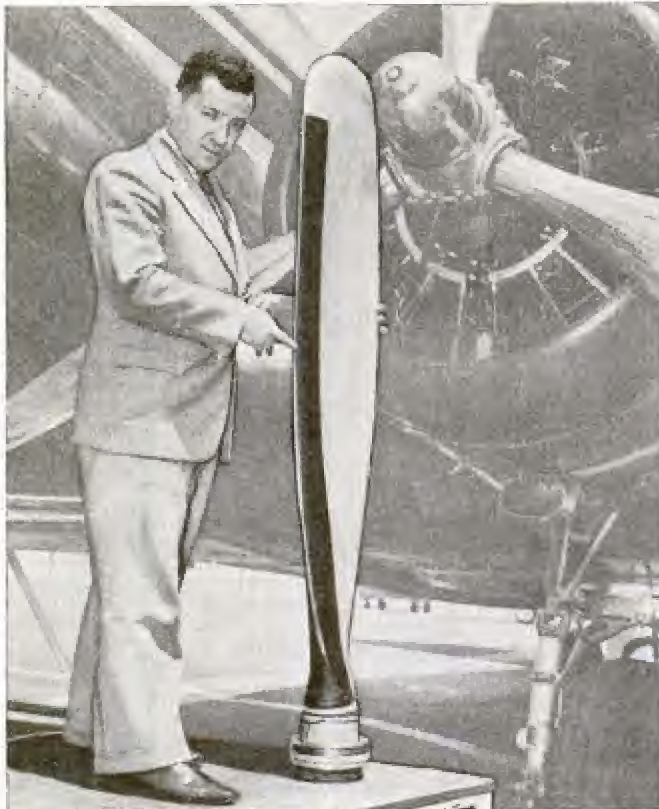
(Continued to page 162)

Erecting all-welded spiral casing for one of the eight 90,000-horsepower hydraulic turbines



71623

De-Icer for Airplane Propeller Is Made of 'Electric' Rubber



Rubber strip on edge of blade carries warming electric current

Strips of rubber treated with chemicals to permit the passage of electricity are used to prevent the formation of ice on airplane propeller blades. The strips are attached to the leading edge of each blade. Heat produced by the electric current passing through the material keeps moisture from freezing, an advantage over ordinary de-icing methods which do not begin to function until after the ice is formed. The device was developed by Dr. Louis Marick of the United States Rubber Company development division in cooperation with the engineering staff at Wright Field.

71694

Earth's Supplies of Oil Will Last For Estimated 300 Years

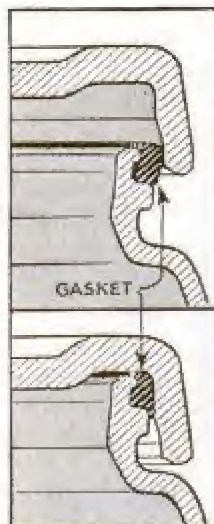
Petroleum supplies of the entire globe should last for about 300 years, in the estimate of Dr. Per K. Frolich of the Standard Oil Development Co. This assumes consumption at the present rate, discovery of new reserves where they can be reasonably expected, and unhindered production and distribution. While the United States encloses only 5 percent of the earth's land area, it contains 15 percent of the area of structures most favorable for the occurrence of oil fields. He estimated that the 46 billion barrels thus far discovered and

partly extracted in this country represent less than half the oil we shall eventually pump, and that America would contribute about 100 billion barrels of the earth's ultimate 600 billion barrels, existing and yet to be found. Back of the oil reserves stand coal beds, containing an estimated three trillion tons. Methods for converting solid coal into liquid oil are already in use, but gasoline from coal is not likely to be cheap, Dr. Frolich said.

71655

Pressing Lid Seals Fruit Jar; Gasket "Molds" to Rim

By use of a "side seal glass closure," fruit jars for home and factory canning may be readily sealed. A pliable plastic material is used as a gasket to fit around and slightly above the top of the jar. When rubber becomes plentiful again, either natural or synthetic rubber gaskets may be utilized. When the cover is placed over the jar and gasket, and firmly pressed, the gasket itself is compressed, and its upper edge projects to "mold" itself over the top edges of the jar. There is no glass-to-glass contact at any spot. The top is readily pried off when the jar is to be opened. The design was developed by the Hartford-Empire Company, and offered freely to the industry as a contribution to the war effort.



Pressing lid seals fruit jar. Upper inset, before sealing; lower, how gasket "molds" over lip of jar

Propeller Anter, 1230-6th Ave., N.Y.C., N.Y.

*Navy Dept.
Office of Public Relations, Washington, D.C. 690*
"Hellcat" Is Fliers' Own Answer to Jap "Zero"
Mrs. Colwell



U. S. Navy photo

Answer to Navy pilots' appeals for "more speed and more climb" is the Grumman Hellcat fighter plane

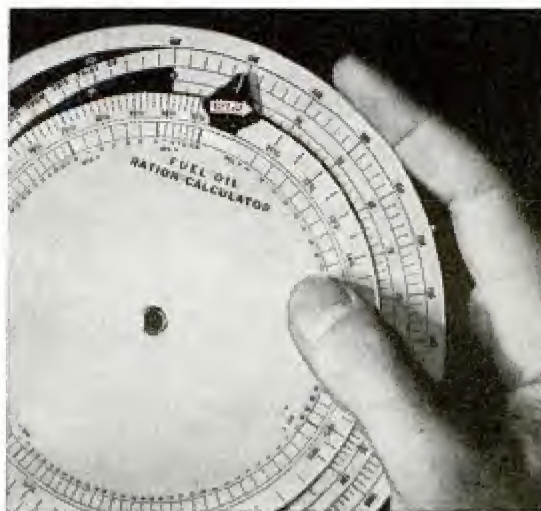
Developed in the dark days after Pearl Harbor, the Navy's newest fighting plane, the Grumman "Hellcat," (F-6-F) is the specific answer to pilot pleas for "more speed and climb," and "something that will go upstairs faster." The Navy calls it one of the world's fastest fighters, and considers that with it and the Vought "Corsair," our Navy has the two finest shipboard fighters in the world. Navy pilots quickly learned that they could not fight the Jap "Zero" on its own terms, because the Jap plane held the advantage in climb and maneuverability over the Navy standby, the earlier Grumman "Wildcat." But by taking advantage of the "Wildcat's" superior armament, armor, and leakproof tanks, the

Navy pilots eventually piled up a 5-to-1 ratio in victories over the Zero, and authorities have declared the "Wildcat" had a great share in saving the Pacific. The "Hellcat" is bigger than its predecessor, is equipped with a high-altitude Pratt & Whitney engine, is thousands of pounds heavier than the "Wildcat," carries .50-caliber machine guns, and has additional space for ammunition for prolonged air battles. It retains the "barrel" shape, an aid to pilot visibility, but has a low wing instead of the familiar midwing design of the "Wildcat." Its wings fold, to enable carriers to stow additional numbers of planes. The "Hellcat" is equipped with a new flexible type gasoline tank.

'Rationing' Dial for Oil Users Shows Daily Fuel Allotment

With a simple calculator made of two paper disks, you can determine at any time during the winter whether you are keeping within your fuel oil allotment. First, the pointer is set opposite the oil allotment for the year. Dates are printed on the inner disk with percentages showing how much of the heating season has passed. After the date is located, the figure opposite it on the outer disk tells your fuel oil allotment up to that day. Knowing the amount you have used, it is easy to figure whether you have been burning too much oil.

After pointer is set opposite allotment for year, the figure opposite date tells if you have been burning too much fuel oil



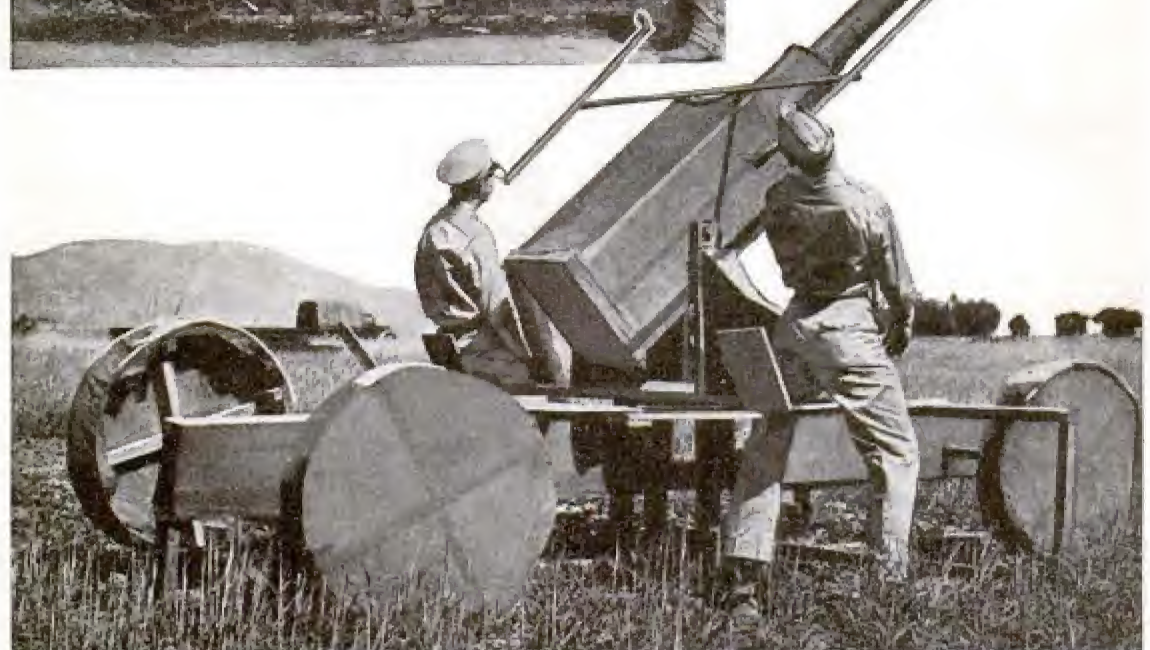
DUMMIES



Latest trick of camouflage is bad camouflage that "conceals" dummy equipment which causes enemy to waste bombs. Shark-toothed dummy (top) may be covered with "flat-top" of fish net that does not blend in with surroundings when viewed from above



If you half close your eyes, the mock motor convoy (left) appears somewhat as it would to an enemy pilot. Contours are realistic and might inveigle fighter to drop down for strafing column. Troops before net are "weaving" it with burlap to hide a truck



The sharp eye of enemy reconnaissance would be quick to spot the gun below as a dummy. Fliers would be instructed as to its exact position, but next time they fly in low over the "fake" they would be trapped with a real gun that replaced the dummy

GO *to* WAR

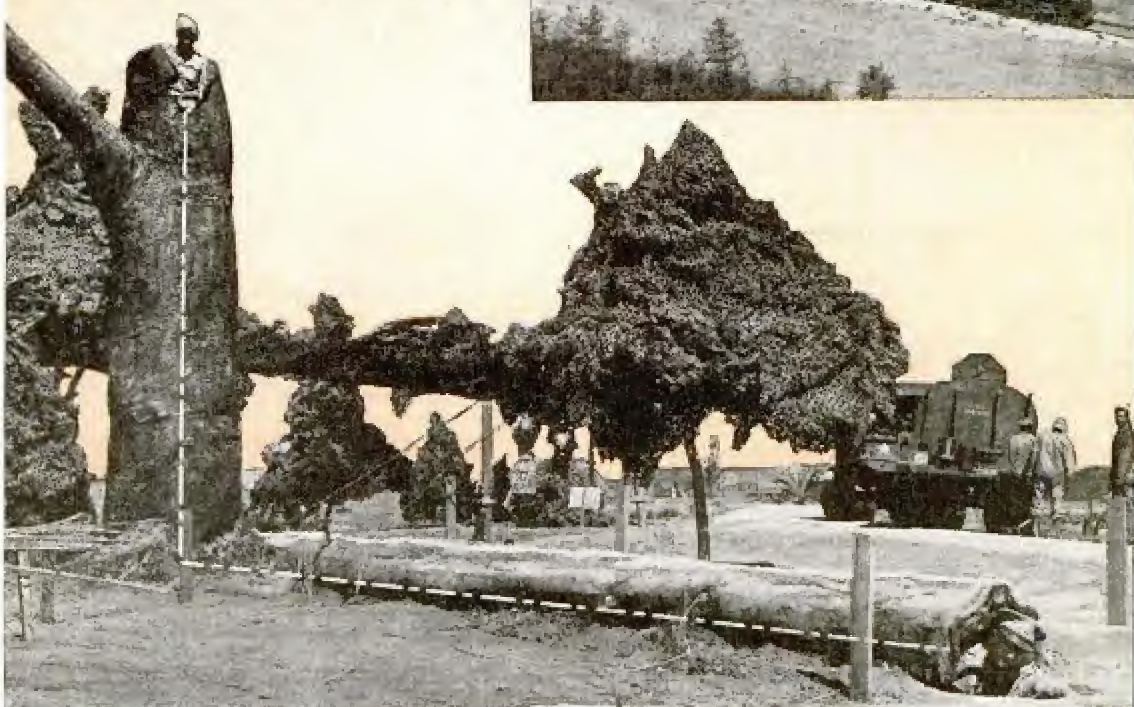


From the air the fighter plane (above) looks like a real P-40 parked alongside an advance landing strip. It is made from scrap wood and sheet metal



Left, dummy field gun with dummy crew is poorly camouflaged so foe will spot it from above and be scared away. Phony gun is made of wood and canvas

Below, observation post made of dummy tree stump and "dead log" concealing tunnel (note man crawling out). Right, model of train on gunnery range



71675

Invisible Ink "Branding" Worker Shows in Ultraviolet Light



A factory worker shows his "password" under ultraviolet lamp

Workers in war plants can be given a semi-permanent identification mark with a "brand" stamped on the hand with a secret chemical. Invisible in ordinary light, the brand shows up plainly when the hand is held under an ultraviolet lamp at the factory entrance. The chemical is impervious to soap and water but can be removed by application of another secret preparation.

71698

Tough Plastic With 1,000 Uses Is Grease- and Gas-Proof

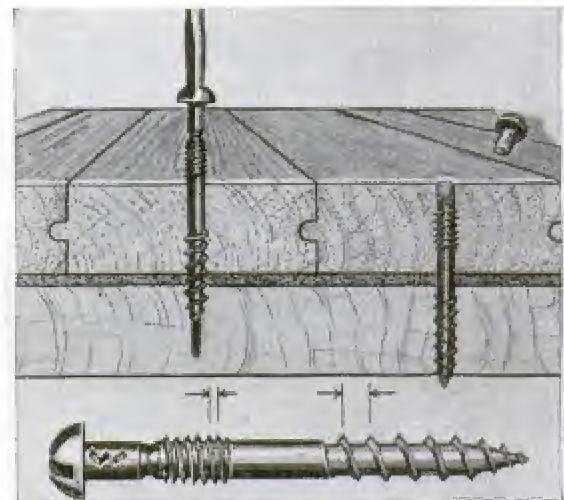
Although few persons will ever bother to learn its name, polyvinyl alcohol resin will be found in millions of homes and thousands of industrial plants in the post-war era. The plastic, developed by E. I. du Pont de Nemours & Company, has a thousand uses ranging from grease- and gas-proof coating for paper to rubberlike molded articles, adhesives, printing plates, emulsifying agents for waxes, resins and oils, coating for nylon, rayon or other fibers, and transparent films for wrapping any sort of item. Films obtained by dipping or spraying will also protect polished metal surfaces. Among war uses for the plastic

are the manufacture of hose assemblies for airplanes, trucks and tanks, and grease-resistant aprons and gloves for war workers. Gaskets, washers and molded articles made of polyvinyl alcohol can be immersed indefinitely in oil without harmful effect. Sheets of the plastic may be used for lining fuel tanks. A thin coating on rayon or similar fibers prevents breaking during weaving or knitting. Experiments are now being conducted with printing rolls made of polyvinyl alcohol because of its resistance to new fast-drying inks that cause ordinary rolls to deteriorate quickly. Other possible postwar products include surgical sutures, photo films, stencil screens, and oil-resistant thread.

71651

Threads on Non-Slip Screw Pull Wood Parts Together

Wooden parts are locked firmly together with a screw that has two threads of different pitches. The difference in pitch—coarse threads near the point and fine near the top—prevents slipping of the parts and guards against contraction or expansion of the wood. To install, the screw is placed in a small hole drilled to about three-quarters of its length. When the parts are tightly joined, the head of the screw is snapped off at a point just below the surface. The small hole can be filled easily with plastic wood. This non-slip screw is especially useful in building boats, trailer bodies, furniture, and in all kinds of fine cabinet work.



Two threads of different pitch lock parts together

16 Electrochemicals Dept.
Wilmington, Del.

POPULAR MECHANICS
Wilson Mfg. Corp.
152 W. Erie St.
Chicago, Ill.

Am. Kraft, Inc.
215 W. Superior St., Chicago, Ill.

Harold A. Voorhes, Major.

71581

Mockup of Bomber Used to Train Radio Men

Aircraft radio mockups, complete in every detail, are used by the Army Air Forces Training Command at Scott Field, Ill. to teach communication installations as they operate in four different bombers. Constructed of plywood, with one side open to facilitate classroom operation, the mockups demonstrate the radio equipment and acquaint the student-soldiers with the precise location of the various parts. There are replicas of the Flying Fortress, the Mitchell, the Liberator and the Marauder bombers, with radio equipment in each placed as it is in the actual planes. The first task of the student is to learn tuning procedure on all equipment, and when he has mastered this, communication is carried on between the mockups. These procedures keep a student alert and give him receiving and sending experience.



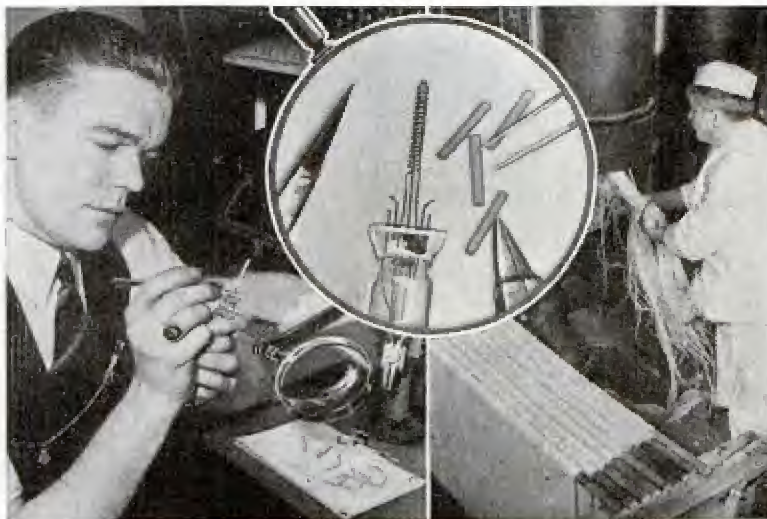
"Semi-mockup" is what students call plywood replicas of bombers in which radio equipment is placed exactly as in real planes. They are used to teach radio men. Above, general view of a mockup. Note name places for crewmen. Right, "navigator" in his position



Sticks of Spaghetti Speed Assembly of Electronic Tubes

Sticks of uncooked spaghetti placed inside the springlike filament coils for electronic tubes hold the coils in place while they are being welded. Once its work is done, the spaghetti is burned away in a

flash. This unorthodox process was introduced by a young Westinghouse engineer, William Hayes, in an effort to remove a war production bottleneck. Formerly, a piece of steel about the size of a seven-penny nail was used to support the delicate coil during the welding operation. The steel piece was often difficult to remove because the coil tended to tighten around it. Sometimes the coil had to be realigned. The use of spaghetti, specially manufactured with the required diameter, has reduced the filament assembly time by 75 percent.



Engineer (left) places stick of uncooked spaghetti inside filament coil, also shown in inset. Right, making spaghetti of required diameter



Hitting solid ground for a two-point landing with his umbrella, this Yankee paratrooper is ready for action

UMBRELLA ARMY



By Roderick M. Grant

"MY INVASION of Africa lasted just eight and a half hours," said Lt. Earl Dittman of Philadelphia, grinning as he shook hands with the two paratroop captains he had not seen since they jumped off from England for Algeria to spearhead the Yankee invasion.

"You were in the ship they shot down near Tifariti, weren't you?" inquired Capt. W. A. Medlin, Jr., of Florence, S. C.

Lieutenant Dittman pulled up one trouser leg to show a big scar in his husky leg.

"I was lucky," said Dittman. "That's one of seven hits I got; but four of our outfit and two of the Air Corps crew were killed, and 14 paratroopers wounded, when the enemy fighters smacked us. Ours was the first plane to go in near Tifariti airport, which we were supposed to grab and hold. We had no fighter protection, no gun turrets, and they really poured it into us. A 20-millimeter shell burst inside the C-47, killed the co-pilot and crew chief and three others outright—Pri-

These sky-riding infantrymen spearheaded invasions of Tunisia, Sicily, Italy, New Guinea



Silk umbrellas dot the skies in a mock attack at Fort Bragg, prelude to Italy

vate John Mackall died later—and we had to crash-land.

"Two other C-47's saw what we were getting and hit the dirt, and all of us who could move dived out of the planes for cover. There wasn't any. The fighters came back and raked us.

"I got mad. I was never so mad in my life. I wanted to fight, but I had only a pistol. I



OWI photo by Palmer

Finishing training at Fort Benning, a grenade-throwing paratrooper tries his pitching arm with a pineapple



← Before starting on a mission, the staff of an airborne regiment studies its objective on a sand table

DECEMBER, 1943

Lt. Col. C. J. Hirschfelder



U. S. Army Signal Corps photo
Oscar and Nellie, the dummies, rest between tests in parachute packing shed at Camp Mackall, "GHQ" of Airborne Command

tried to start a duel with my pistol against the machine guns of those fighters, but I couldn't even load it. My left arm was useless. I found I had holes in my elbow and upper arm, my chest, back, thigh and calf—seven of them. I hadn't noticed them at first, but when the shooting was over they began to hurt."

The wounded of that first airborne Yankee invasion flight in the Africa theater lay on the desert while those who could walk trudged 12 miles for help.

"The corpsmen did a swell job of patching us up," Dittman related, "but while we were lying there dozey with morphine, the Arabs came along and stole our cigarettes and raincoats and anything they could carry. Army trucks picked us up the next day. I spent five weeks in a hospital, and here I am after my eight-hour invasion!"

Dittman, Captain Medlin and Capt. H. C. Tipton of Horn Lake, Miss., had met at Airborne Command Headquarters, Camp Mackall, N. C., the training ground of the plane- and glider-borne infantry, named in honor of Private Mackall, one of the first Yankee paratroopers to die in action. Here

in the Carolina sand hills thousands of graduates of parachute and infantry schools are getting postgraduate training before shipping for zones of combat. Here the veterans of America's first airborne invasions in Africa and the south Pacific are passing on the lessons they learned to the lean and hard young men who will drop from the skies over Europe and Japan to carry the war back where it started.

In Algeria our paratroopers learned the hard way. They learned there is no substitute for training. They learned that fighter protection is as necessary for airborne invaders as destroyers for a seaborne convoy. After the initial dash from England, every aerial troop transport carried its umbrella of fighter planes. They found that the light machine gun, added to the paratrooper's already heavy equipment, makes a pack of 90 pounds that is pretty tough on the forced march that usually follows a jump. And they discovered that a course in booby traps is a requisite for a long life. Two men of one company were killed when they picked up the explosive fountain pens and pencils dropped by the Germans. British soldiers, but not Americans, were fatally tricked by the booby packages of English cigarettes scattered by the

enemy, to explode when they were opened. Capt. Medlin saw one Arab blown to bits when he toyed with an unexploded "butterfly," one of those deadly anti-personnel bombs that flutter down like a leaf and spray a terrible hail of metal as they light.

Our first invasion by air was both success and failure. Failure because in some cases ground forces landed at Oran and Algiers



pushed inland and took the objectives before the airborne troops arrived. Failure because many of the planes went astray, landed short of gas or were attacked by enemy aircraft. Faulty navigation took some of the C-47's far afield into southern Morocco.

But the aerial invasion was a success in that it confused the enemy into believing a tremendous force had landed. Axis intelligence reported thousands had flown in, and the enemy failed to move when they might have succeeded. Subse-



Parachute packs attached to static line in plane, the men pour out at two per second. Left, guiding the chute down



quently, the paratroopers reinforced and supplied Allied troops scattered thinly on the Tunisian front.

During their five months of intensive training in Commando tactics and low-altitude jumping in England, Captain Medlin said the parachutists learned that the jump from 800 feet, customary in America, is "high altitude" over there. The lowest jump is the safest, giving the enemy less time to hit the troopers as they fall. The practice now is to hit the air at about 300 feet, in the twilight of dawn or dusk. Medlin once bailed out at 130 feet, lowest on record, at 150 miles an hour.

Glider-borne invaders reinforce a field captured by chutists





His chute made a nightcap for a Carolina pine tree, but trooper at lower right is packed up for battle

Early in October, 1942, Lt. Col. Edson Raff called the company commanders together and informed them they were to begin preparation for an invasion. From here on preparations and movements were secret. The officers studied maps, aerial photographs and scale models of airports "A" and "B" without knowing whether they were in Norway or France or Africa.

In the last week before "D" Day the planes and equipment were allotted, certain items discarded to save weight, and finally the troops moved to the takeoff airports one midnight, minus any telltale insignia or jump boots which would identify them.

Saturday, Nov. 7, was "D" Day. There were two plans. Under the War Plan they would take off at 2:30 p.m., fly direct to Africa, jump at midnight and take Airdrome B—this the objective of the 2nd Battalion. Under the Peace Plan, contingent on a friendly reception and fifth column help, they would take off at 9:30 p.m. and land at Airdrome A at daybreak.



The paratroopers were ready for the takeoff when word came that it would be the Peace Plan. At 9:30 p.m. the Yankees took off. They headed south across Europe in Douglas C-47's, the familiar DC-3 of our air lines. The paratroopers in his plane slept on the floor, Captain Medlin recalls, but he didn't. His pilot had informed him they might run out of gas over the Mediterranean and he should be ready for the jolt and quick evacuation of his men. It was not a quieting thought.

Until they were in the air that night of November 7 only the officers knew they were headed for Algeria, 1,500 miles south. The planes were supposed to keep together, but it was impossible to maintain formation in the thick weather over Europe. On the ground at the objective each company was to assemble separately. D company was to march to Airdrome A (Lasenia). The remainder of the battalion was to attack Airdrome B (Tafaroui), a mile or so from the jump field.

Each plane carried 14 paratroopers. They landed at various places in North Africa. Altogether, 120 men jumped. Several planes made a rendezvous and landed in a dry lake bed, a sebkra, where snipers took pot shots at them and one bullet hit an antitank shell inside a C-47, exploding it. Shortly afterward, nine planes circled overhead. The grounded pilots radioed a warning of snipers, and the C-47's overhead sighted two half-track cars they suspected were firing on the grounded planes. Colonel Raff was in the lead plane with Colonel Bentley, Air Corps, task force commander. They decided to jump and knock out the half-tracks. They jumped. The half-tracks turned out to be American.

The planes had landed in the dry lake because Lasenia airport was defended by



Douglas transports like these, carrying an aerial task force, flew the paratroopers from England to Africa

antiaircraft. While they waited, most of the missing craft from England showed up; but those grounded were nearly out of gasoline. Meanwhile Tifariti was captured by ground forces, which radioed the paratroopers to come over. Three planes took off from the sebkra in late afternoon for Tifariti, only to be ambushed in air by the enemy fighters. That was when Lt. Dittman ended his brief invasion and six in his plane were killed.

Shortly thereafter, Spitfires arrived from Gibraltar and in two minutes knocked the enemy fighters out of the sky.

From here on, the job of the paratroopers was to grab one airport after another and



A sky trooper keeps his carbine dry as he wades ashore



Copyright: British Official photo

keep one jump ahead of the German airborne infantry. Captain Medlin's company flew to Maison Blanche, 10 miles east of Algiers, where bombing by the Nazis became a nightly unpleasantness. In the first raid a German followed a C-47 to the field, and, mistaken for a friendly plane, was allowed to come in close where it scattered booby traps, butterflies and triangles, the latter a steel

British chutist gets harness in control before releasing



Perfect descents in action, demonstrated above, result from rigorous training at home. Below, two paratroopers at Fort Benning, Ga., demonstrate on the mat the proper method of tumbling forward on hitting the ground



three-pointed weapon like the historic cheval-de-frise, to puncture tires on runways. In the biggest raid, Stukas gave Maison Blanche a devastating shower. The first bomb hit 40 feet from Captain Medlin, killing a man 150 feet away. Medlin found a piece of shrapnel in his hand. In the subsequent plastering 14 men were killed, 28 wounded, 11 planes wrecked.

On Nov. 15 Colonel Raff led a flight of 300 paratroopers to nab the base at Youks Lebains. The paratroopers bailed out over the field at 10 a.m.

"The French," reported Captain John T. Berry of the 503rd parachute infantry, "had machine gun emplacements around the field. They told us they had orders to fire on us but wouldn't do it when they saw the American planes. It probably would have been disastrous for us if they had. Casualties were three broken legs and about 15 men out with injuries which were soon all right."

Besides their initial mission of invasion, the paratroopers—who are primarily infantry qualified as parachutists—fulfilled numerous reconnaissance, scouting and demolition tasks. Captain Berry tells of one of these.

"On December 27, 29 men and one officer, plus two non-coms from a French parachute company, were sent on a demolition mission to blow a bridge on the supply line from Tunis to Rommel's army between Sousse and Sfax. The planes took off from Thelepthe at 9:30 and jumped at 12. Reports on what happened are a little mixed. The Air Corps said they dropped the men 1½ miles from the bridge, and Lt. Deleo, who led the men, said they were dropped in the wrong



Loading a 75-millimeter gun to be flown to an occupied field

place. When daylight came the men still were not near the bridge. They moved toward it and tried to do as much damage as possible by blowing out rails. Two companies of Germans and Italians were closing in. Lt. Deleo told the men to pair off, go in all directions, then head west. Lt. Deleo took the two French non-coms. They knew that country, so he and three men finally made their way to headquarters. Later one man reported in. A total of one officer and four men came back. The mission failed. The German broadcast said the men had been eliminated."

Meanwhile Captain Medlin, with the initial task of the paratroopers completed, was sent to a hospital in Algiers for treatment of an injury



At left, a tumbling paratrooper demonstrates landing technique

suffered in England. In the bed next to his lay a young German officer, veteran of 250 bombing missions over England, the Low Countries and Africa. He had been shot down over Algiers. Surly and uncommunicative at first, he broke down a little after smoking Medlin's cigarets for three weeks. When he did talk, he said Germany would rather lose the war to America and England than endure the vengeance Soviet Russia would exact in victory. The German was amazed at the light-hearted spirit of the wounded Yankees. Men who laughed were foreign to him.

"My people never laugh," he said. "They only work. The women work, the children work.

(Continued to page 152)

Men Adrift "Store" Water Best by Drinking It

77545



How to survive indefinitely when adrift at sea was the problem these men volunteered to help solve by remaining afloat in life rafts. Left, they found great success in fishing. Below, resting under tarpaulin, used for shelter and as rain-water trap



Where is the best place to "store" drinking water on a life raft? In the human body itself, according to Maj. George W. Holt, flight surgeon for the Army Air Forces School of Applied Tactics. As a result of a test of rafts and their equipment, in which nine officers and men voluntarily floated for days in the Gulf of Mexico, Maj. Holt declared that, in the event of rain, it is wisest to give each man at least two quarts of water within two hours. Former practice generally was to dole out the water sparingly, hoping to preserve some until the next rainfall. "The human body is the best storage place for water on the raft—it prevents evaporation and contamination from sea salt," Maj. Holt declared. "Besides being well stored in the body, the water satisfies the man's thirst, and the large quantity does them more good than small amounts over a long period of time."

If the body is dehydrated, the water will be absorbed and held by the body, though the men must exercise care to prevent loss of water by perspiration. He may soak his clothing in sea water, immerse himself in water in the raft, or remain beneath the horizontal tarpaulin, part of the standard equipment. The volunteers also reported that the "seven-man raft" will provide comfortably for only five men, and the "five-man raft" comfortably holds only three. To protect the men making the experiment, a crash boat stood by the rafts.

Wheeled Frame Wades Into Surf to Bring Boats Ashore

77554



Seagoing wrecker wheels right into sea to embrace and retrieve boats

Mounted on wheels, a mammoth frame used by both Army and Navy, functions on the beach somewhat like a wrecker truck. It is used to retrieve boats from the water and haul them ashore, or boats can be taken from shore to water. In landing a boat, the frame is backed into the surf until it settles over and around the craft, which is then chained to the structure. The whole frame, with the boat inside, is then hauled ashore.

Office of Public Relations
Orlando, Florida

By James Colvin

IN FRONT of you green-clad mortar crews are lifting, passing and fusing their ammunition, and dropping it into their belching weapons with a body rhythm reminiscent of a double-reverse in the backfield. Far across this firing range at Edgewood Arsenal, where ridges rise toward a dark green skyline of forest, a manmade cloud is forming in a beeline following the mortar's traverse.

The thumping rapid-fire of the weapons seems to have voice, reassuring to us, ominous to our enemies. For these weapons and men—and, indeed, this entire home base of the Army's Chemical Warfare Service—are the teeth in a threat to the Axis, three times made by the President of the United States: America does not intend to start gas warfare, but if the Axis starts it, we'll finish it.

You've seen proof of our readiness here. You've seen how a whole platoon of mortar crews

IF *the* AXIS USES GAS-



Two main tools of Chemical Warfare Service are incendiaries, (above: burst of white phosphorus) and smoke screens. Below, screen hides photographic unit





Mounted soldiers and horses, both masked, emerge from a smoke cloud. Smoke may be used to blind the enemy or hide your own side's movements

CHEMICAL WARFARE AGENTS			
	Name	Odor	Effect
Vesicants	Mustard	Garlic-Mustard	Burns skin or membrane
	Lewisite	Geraniums	Irritates nasal passages; later skin burns, poison
Lung Irritants	Chlorpicrin	Flypaper	Causes severe coughing, crying, lung edema
	Diphosgene	Musty hay	Causes coughing; breathing hurts; eyes water; toxic
	Phosgene	Musty hay	Irritates lungs
	Chlorine	Highly pungent	Intense immediate choking
Tear	Chloracetophenone	Apple blossoms	Makes eyes smart, shut tightly; tears flow; temporary
	Brombenzylcyanide	Sour fruit	Eyes smart, shut, tears flow. Effect lasts some time
Smoke	HC Mixture; Titanium Tetrachloride	Acrid	Harmless
	Sulphur Trioxide-White Phosphorus	Burning matches	(1) Liquid burns skin if allowed to remain (2) Burning pieces adhere to skin, clothing

Above is a chart of some of the chemical warfare agents. Below, soldier protects himself with a metal "shield" while fighting an incendiary bomb



hid with their peeps in a roll of the meadow you thought no deeper than a plowtrack. You've seen them burst into the open, roar up to your point of vantage, roll out mortars and ammunition, drive in aiming stakes, slap mortar base plates onto level patches, hitch on the barrels, and cry "Squad ready!" almost before you'd convinced yourself they were really there.

And you've seen what they can do with mortars—simple, chunky weapons that resemble ambitious stovepipes.

"If these crews are well trained," says the colonel, your guide, "they'll put their fire just where the other crews laid that smoke screen."

"Two rounds!" and "Fire!" calls the platoon leader. The mortars cough; sandbags weighing down baseplates jolt into the air and fall back; projectiles whirl high into the air, like oversized game birds.

The mortar crews are already retiring to their peeps before the shells land—right on the nose—in the midst of the earlier smoke screen. The colonel is pleased and proud. The mortar men are grinning; they expected direct hits. Their peeps disappear over a rise.

Proficiency like that supports what the President said:

"Any use of gas by any Axis power . . . will be immediately followed by the fullest possible retaliation."

The mortar shells today were filled with white phosphorus. That's primarily for making smoke screens, though flaming bits of phosphorus will cause incidental havoc to the human skin.

But if the Axis chooses to have it so, those shells can well be filled with

Chemical mortar crew, dragging their weapon on a cart, fight mud and grade in straining to get into position to open fire



something else. With Lewisite, for instance, that reeks of geraniums and irritates the nasal passages, and burns the skin and poisons the body. Or the new nitrogen mustards, that blister, and attack the eyes, and kill. Or with other liquids and vapors that sear, and suffocate, and blind.

In war you must be ready for anything. Part of our preparedness program includes huge arsenals, filled with deadly doses of gas, ready for the challenge if it comes.

Dabblers in horror have often suggested that the Axis, harried by the specter of defeat, would resort to gas, perhaps by an air raid to douse civilians. Chemists generally scoff at that idea. It would take more thousands of planes than the enemy seems to have to make even one such raid effective, and we have the promise of both Churchill and Roosevelt that retribution would be swift and sure. But attack against soldiers in the field is another matter. Though they haven't tried it against us, they might. (The Chinese, though, report more

than 1,000 incidents in which the Japs used gas, and show photographs to prove it.)

Gas is perhaps as powerful a psychological weapon as a physical one. The danger of it burdens all armies with heavy protective equipment. Fear of it may lower a soldier's morale. Threat of it ties up unnumbered workers, in manufacturing protective equipment and in learning the rites of decontamination.

Chemists uniformly seem to feel gas war-



Monster mechanized smoke generator can obscure a large area



United Nations' stand is that we won't open gas warfare, but we're ready if Axis does. Bombs being put aboard car for shipment to loading plant

fare is more humane than any other kind. They cite figures from the last war—95 percent of the Americans wounded by bayonet died; 24 percent wounded by bullets or shell fragments died; but only 2 percent of the 71,000 American gas casualties died.

But since the thing unseen is most feared, and potent gas concentrations may be invisible, statistics don't completely lay the ghost. What should reassure is the confidence of the C.W.S. that we have the answer to whatever the enemy may try.

They call our service mask the best in the world. For protection against blister gas, every soldier is given two protective covers, in which he can crouch in the event of airplane gas spray. There is protective clothing, protecting ointment to neutralize vesicants. A fat-bodied tank truck can decontaminate huge areas, soldiers sitting on its fenders to hose down the vapor-laden terrain. There are chemical detectors—crayons, paints, powders and papers—that change color in the presence of gas, and even by their altered hue indicate which gas is present.

Modern flame throwers cover a target with fuel that continues to burn wherever it lands

These are for defense; but above all, we're ready to dish it out. In the last war, gas attack often depended on the whimsies of the wind; a change of breeze might gas your own side. Now, gas can be laid wherever artillery can fire or planes can fly. Our Mitchells or Bostons can carry 1,000 pounds in spray tanks. Mortars, 48 to a battalion, can lay down five tons of gas in two minutes.

"After two minutes such fire is useless, because the enemy is either a gas casualty or has put on his mask," Edgewood spokesmen explain.

You watch a show of rapid fire by a mortar crew. Each shell has to be handled four times, and is set off by the force of its

drop from the mouth to the breech of the mortar. The crewmen swing with the precision and grace of a ballet chorus. Fourteen shells are in the air before the first one explodes in a burst of orange on the distant woods. Twenty rounds are fired in 41 seconds!

Or we could use gas in land mines. A distant road on the range explodes in smoke and fire. That was phosphorus, too; it could have been mustard. In 30 minutes, one company can lay out enough mines to contaminate seven miles of roadway.

"Most people," in the words of Maj. Gen.



William N. Porter, chief of the Chemical Warfare Service, "think of us as the men who are working up secret and terrible new gases to destroy the enemy. Actually, by far the larger percentage of our energies and resources goes into protective work, and in that field the most important item is smoke."

Chemical Warfare Service smoke screens shielded the Yanks landing in Africa, and protected them throughout that campaign. The famous raid on Dieppe might have had a different ending, had not one of the shore batteries been improperly "smoked." That was because ships carrying the smoke mortars were sunk.

Mortar crews with their high-explosive and smoke shells may be expected in the front line of any invasion. So delicately are the shells fused that contact with the surface of the water will set them off.

At Edgewood, the mortarmen demonstrate. Far to the left is a broad river.

(Continued to page 158)



Gassed area may be made safe for troops by work of decontamination crew, above. At right, how a soldier protects himself from gas attack while in the open. He wears the service mask, and squats beneath individual protective cover, which is gas-resistant, to safeguard skin against vesicants. Below, spectacular shot of a surprise "gas attack" on troops. Note men dispersing and quickly adjusting masks



Victory Ship Makes 15 Knots, Outstrips Liberty



Sleeker, faster and more powerful than the "ugly duckling" Liberty Ship is its companion, the Victory Ship

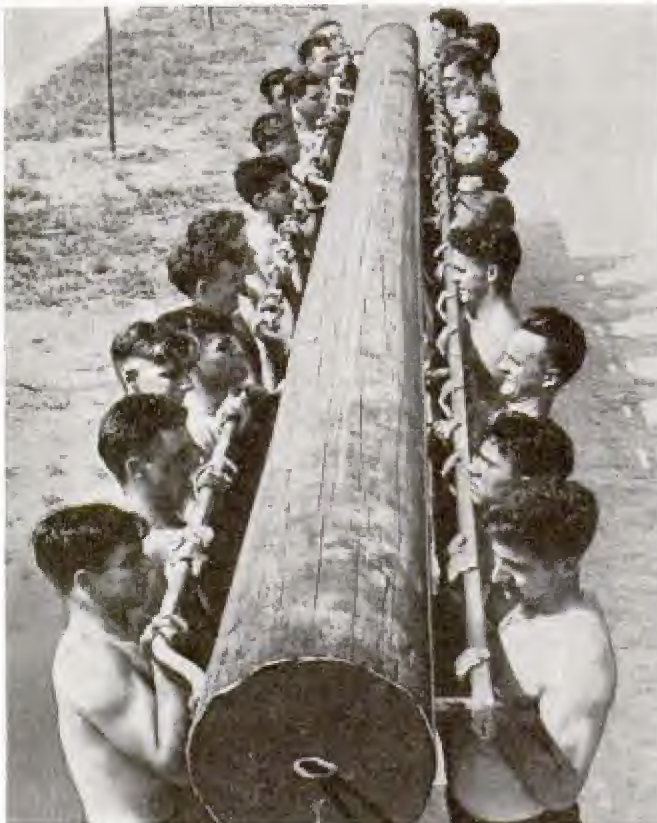
Designed by the United States Maritime Commission as an improvement on the storied Liberty Ships, the newer Victory Ship is faster and sleeker. Its speed of 15 knots is about 4 knots faster than the Lib-

erty models. It has finer hull lines, and has turbine-gear propulsion machinery which delivers more than twice the horsepower of the reciprocating steam engine used in the Liberty Ships.

Sailors Lift 1,400-Pound Log in Drill at Training Station

When the physical training instructor yells, "One, two, three, and up she goes," at the U. S. Naval Training Station, Great

Lakes, Ill., a 1,400-pound timber goes skyward. Bars are attached to each side of the log with space for a dozen sailors. This novel exercise was introduced by Chief Specialist H. W. Hawelka, a former Chicago policeman.



Giant timber serves as muscle maker for Navy at Great Lakes

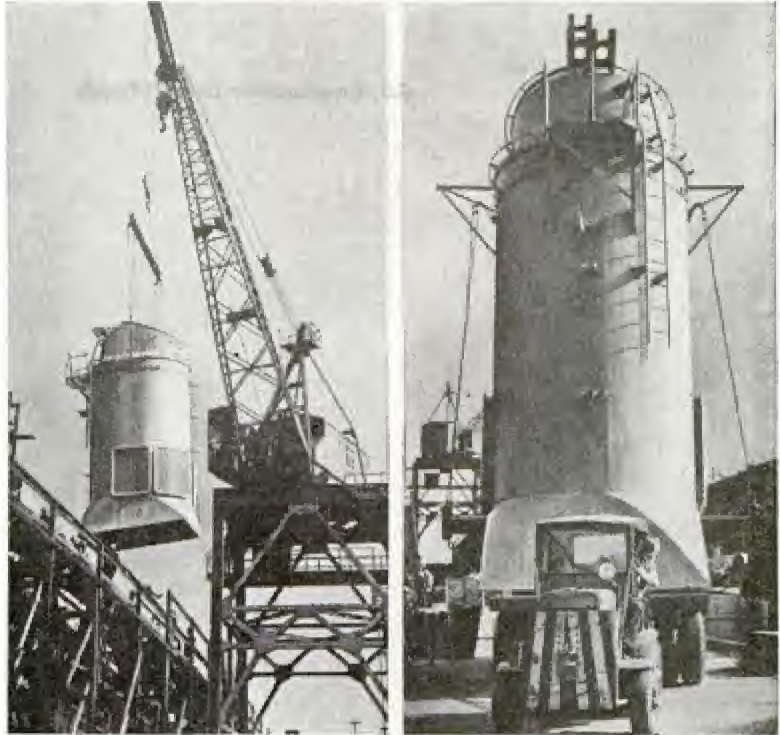
Air Battleship Aims Guns By Central Control

Superbombers capable of carrying half-carload lots of bombs, bigger than blockbusters, across the Atlantic and back again without refueling are promised by Gen. H. H. Arnold, Army Air Forces chief, in Army Ordnance Magazine. The planes will have "eyes" that will help guide them to their targets, or warn of the approach of enemy interceptors, and even plot the course of the pursuers. For defense, they will be armed with cannon even larger than the 37-millimeter guns now carried by some fighters. These cannon will be mounted in multiple turrets, operated from a central aiming position, comparable to the fire-control system of surface warships. While paying high tribute to the Flying Fortresses and Liberators, Gen. Arnold declares the new superbombers will render these craft obsolete.

Ship Funnel Rides on Trailer to Outfitting Dock

In an era of widespread prefabrication, shipyards present strange sights, but few more novel than the sight of a West Coast yard's "jitney" mounting the huge funnel of a destroyer. The jitney is a form of cut-down tractor-truck. On its run from the metal shop to the outfitting dock, it hauls the funnel from the spot where it was made to its destination aboard the ship being completed. At the dock a heavy-weight traveling crane boosts the funnel from the back of the trailer to the destroyer deck.

Truck takes prefabricated destroyer funnel at right to dock where crane lifts it into place aboard ship



One-Man Machine Bales Hay in Compact 'Carpet Rolls'

In actual tonnage, hay is the heaviest of all crops harvested in the United States, yet the mechanical aids to the harvesters have heretofore still left a tremendous lifting job dependent on human muscles. The Allis-Chalmers Tractor Division now has announced a one-man pick-up hay baler intended to take the backaches out of haying, and convert it to a one-man, family-farm operation. The baler is to be put into production "as soon as machine tools and materials are again available." Its most unconventional feature is the appearance

of the finished bales. They are rolled like strips of carpet, a procedure said to permit tighter compression than in the conventional square bales. One man—the tractor driver—handles both tractor and baler, which is operated by power take-off. The baling operation is automatic, ordinary binder twine being used instead of wire. Bales are about three feet long; diameter and density can be regulated to suit the need. For easy handling, bales are normally made to weigh 65 to 70 pounds each. The baler, weighing less than a ton and a half,



is mounted on two rubber-tired wheels, and has a hinged tongue that permits trailing it behind the tractor, for travel over narrow roads or through farm gates. The baler's pick-up mechanism, in combination with the press roll, is said to save the maximum number of leaves, which contain some 80 percent of the feed value of hay. The cylindrical bales, with stems curved around and tightly held, are said to shed water, making the bale more resistant to weather.

Operating by power takeoff from tractor, baler rolls up hay like carpet

7440

SHARPER EYES *for the* FLYING SNOOPERS



Above, Wright Field photographic technicians test new camera equipment in the air under simulated battle conditions. Below, a lens specialist studies new aerial camera lenses



CLIPPING the treetops at five miles a minute, the pilot of a Yankee pursuit plane pulls the trigger. But no rattle of machine guns follows, no bullets rip the hangars flanking the enemy air field over which he skims. This is a photographic strafers. The trigger starts a roll of film unwinding, and the plane brings home a continuous-strip picture of everything within range.

There has been no warning of the approach of the low-flying plane, and antiaircraft weapons are virtually useless against it in the seconds that it was overhead.

Back at his base, the flying snooper's film is processed into a continuous photograph; no overlapping of separate views, no tedious study of faint outlines magnified from a high-altitude shot. The low-level picture is sharp in every detail despite the terrific speed at which it was filmed.

A few months ago no existing camera could achieve these results. Even one-shot pictures from a fast plane were usually blurred. Reconnaissance depended on high-level area photography for a complete picture of enemy installations. Development of the continuous-strip camera is an

City: Capt. Richard L. Andrews, ASW 32162912,
Capt. G. Palmer, N.Y. 714.

outstanding achievement of the war, giving the United Nations a decided advantage in aerial reconnaissance.

A second innovation is a continuous-strip printer which can produce 1,000 nine-by-nine inch prints per hour, a rate many times faster than standard photo-printing machines. Two men can do the job, and they need no air-conditioned laboratory. The portable machine can be operated in an army tent.

From Wright Field also comes word of a copy and enlarging adapter which can be housed in a small trunk and carried in aircraft. Equipped to accommodate both eight-by-ten and five-by-five cameras and made entirely of wood, it weighs about 200 pounds and can be set up in ten minutes. Being transportable by air, it is unnecessary to return to a base to copy or enlarge pictures.

Few details of the continuous-strip camera have been revealed. It can be said that it employs a long strip of film—color film can be used—with no breaks or overlaps, and test pictures made at 300 miles an hour plainly showed gasoline ration stickers on windshields of automobiles.

High-level reconnaissance, too, has been refined to an amazing degree. With color



Photo by Aerial Photography Laboratory, Wright Field
Air officers examine a continuous strip photograph made at low altitude

photography and three-dimensional viewers the photographic interpreters ferret out enemy targets entirely invisible to the human eye four miles overhead.

Two Germans, Karl and Fritz, are marching to headquarters along a path hidden from the air by a grove of trees. A new wing has been added to the staff office building and they are to cover its conspicuous roof with blobs of olive green paint to blend it with the wooded surroundings. Nets are spread from the eaves at a broad angle to the ground so that no sharp shadows will be observed by Allied photo reconnaissance.



Above is the sectional type of picture formerly standard; below, the new continuous-strip photograph





OWI photo
Geological Survey mappers use a Sketchmaster to transfer selected map details from aerial photographs to acetate base map

An eruption of antiaircraft fire startles them. Far above, a white trail of vapor is being drawn across the sky. Flak bursts around the scarcely visible Yankee reconnaissance plane and Messerschmitts whine up to intercept the aerial snooper. But the Yankee spirals up to a rarefied level where Messerschmitts cannot breathe. His film exposed, he heads for home.

The films are quickly developed and soon a courier leaps from a jeep to deliver the prints, still damp, at a door marked N. A. P. I. U.—North African Photo Interpretation Unit. Inside it men are studying maps and photographs. Filed on shelves along one wall are prints made from every photographic sortie flown by Americans and British from African fields. Cabinets hold an enormous range of information from the disposition of enemy antiaircraft batteries to the detailed characteristics of a Jap Zero.

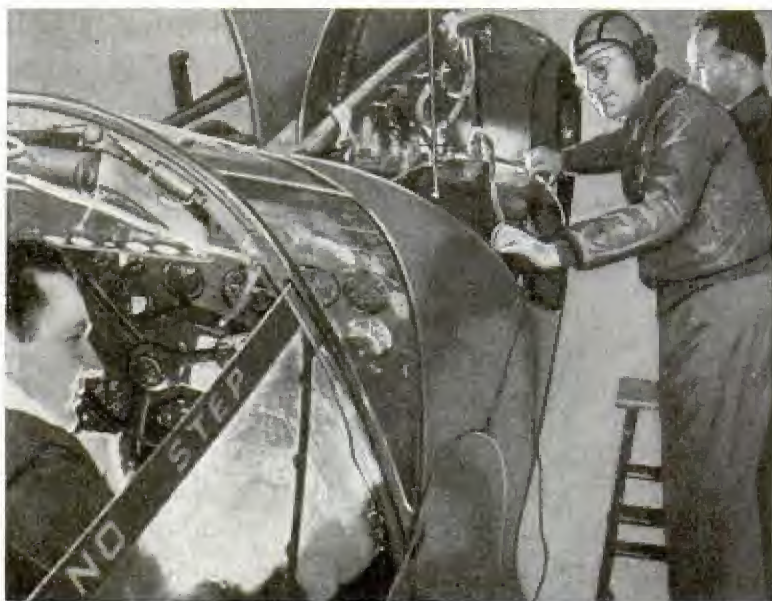
The fastest planes are used for aerial reconnaissance. Here a camera is being installed in a Lockheed "Lightning" fighter

A Flight Lieutenant receives the prints, captioned "Locality X," and since there is reasonable doubt in the military mind that the pictures actually represent the place named, the first move is to plot and identify the sequence of photographs, locating them beyond doubt on detailed maps. A sergeant compares the curve of the railroad, the crossings, the shape of the air field and finds they tally with the maps. New roads appear on the new prints, but their construction had been noted on a previous sortie. The sergeant proceeds to make an overlay, which is done on a sheet of tracing paper over the map, and is merely the borders of the area embraced by the photographs.

The overlay and the run of prints are spread out on the captain's desk. This run, or sequence of photographs was made at a set interval between exposures as the plane flew across its objective, so that the pictures, when equally overlapped, will make a long narrow picture of the ground. The overlap is such that every object

is photographed at least twice, from slightly different angles.

The captain examines the sequence first in the form of a mosaic, using an ordinary magnifying glass. He sees nothing unexpected. Then he takes the first two prints and lays them side by side, places his stereoscope in position and bends over it. Moving the viewer slowly, he sees a startlingly real three-dimensional model of Locality X. Following the railroad tracks, he



pauses at the barracks of Karl and Fritz. There is a new trench, several trucks, and the grass is beaten down where the troops cross the railroad. His eye moves on toward the air field, dotted with specks whose shadows on the ground make them stand out in relief.

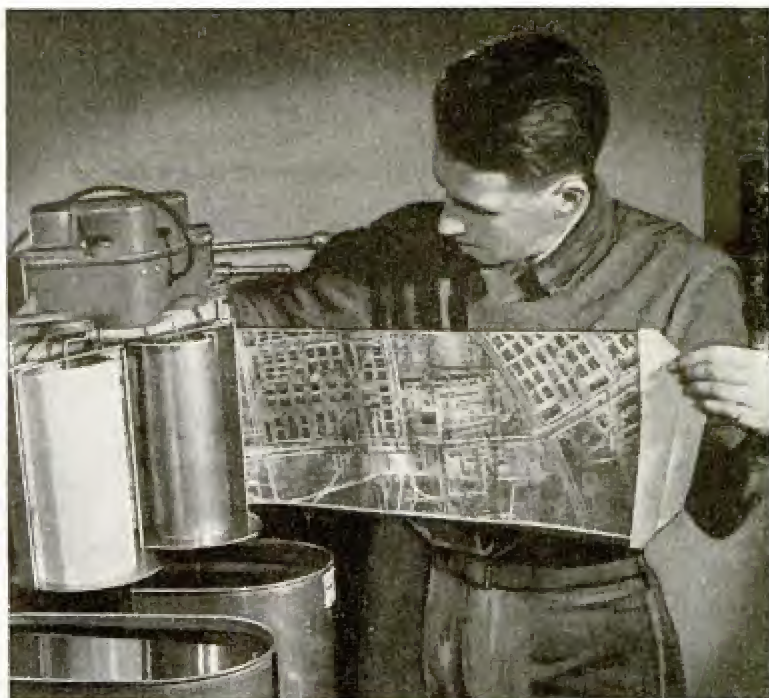
Knowing the exact altitude, the captain can compute the dimensions of the planes. He reaches for his aircraft identification manual showing the silhouettes, dimensions and other data, and takes inventory of the enemy bombers, transports, fighters and courier planes. Moving the stereoscope back across the field, he looks for bomb craters, notices that one hangar has lost its roof, and through the girders spots a fighter plane undergoing overhaul. Suddenly he calls to a lieutenant at the next desk, who was busy computing the speed of a ship at sea by its wake.

"Look down through those trees, Bert!" says the captain. "Notice those men? And if there's one path through that grove there are a dozen, and they all converge right by those treetops. See that liaison plane on the side of the field? And I think those are reconnaissance cars parked right here."

The lieutenant examines the prints.

"Yep! Those men must be camouflaging a roof—a new roof. It's big. Must be a headquarters. Won't the bomber command love to know about this."

The prints were rushed over to the Bomber Command, a red pencil marking the site of the hidden headquarters. When the pilots came in to be briefed before their next mission, the commander had laid out the prints in mosaic form, and the men



The continuous strip printer above, developed at Wright Field laboratory, is portable and can be used at advanced bases for rapid printing of aerial photos. Below, loading photoflash bombs for reconnaissance flight



*Margaret Woods
Fall Church, Va.*



OWI photo

Making a magnified stereoscopic examination of Army Air Force photos to select topographical data which will be applied to the base map

who put out the lights in Germany and its captive outposts gathered around to study them. Two ships were detailed to flatten the newly found headquarters in the grove.

That night Karl and Fritz dove into the slit trench beside their barracks as the Yankee bombers droned overhead and plastered the air field. Two of the bombers seemed to detach themselves from the flight as they crossed the railroad. Skirting the air field, they dumped their bombs precisely on a certain spot in the grove.

Headquarters mushroomed into flaming debris. Another Nazi nerve center had been shattered.

Next day the fast flying eye again looked down on Locality X, and that afternoon the captain, peering through his stereoscope, noted a large gap in the trees. On the ground lay the wreckage of a building. A few ants were crawling over it, among them doubtless Karl and Fritz, some of their faith in their own camouflage technique exploded.

In addition to reconnaissance in the zones of combat, Army Air Force cameramen have been busy mapping the world on a vast scale for military purposes. In 10 recent months more than

1,600,000 square miles of the earth's surface were photographed and the resulting pictures made into maps by the Geological Survey of the Department of the Interior. The surveyed surface is equivalent to the combined areas of pre-war Belgium, Czechoslovakia, the United Kingdom, France, Germany, Hungary, Italy, Poland, Norway, Rumania, Spain, Sweden and Yugoslavia.

This tremendous job was accomplished by the fast technique of Tri-Metrogon mapping. The areas covered were previously unmapped or inadequately charted sections of African desert, Asiatic and Alaskan wilderness and South American jungle.

The actual mapping was done by a staff of 250 technical personnel in the Geological Survey. Aerial cameras, equipped with wide-range Metrogon lenses and operated by Army pilots, provided the photographs from which the Survey compiled the charts. Under the old field methods of mapping, the same number of persons would have labored at the mapping job ten years to cover (although in more detail) an equivalent area.

The Tri-Metrogon method uses three



Barefoot to prevent damage to the map, chart-makers of the Geological Survey add place names and other data to an acetate base map

cameras set up in an airplane so that they obtain a set of simultaneous exposures covering an area from horizon to horizon. The central camera points vertically downward, the ones to the right and left obliquely downward, so that the horizon appears near the upper edge of the photographs. The oblique photographs overlap the corresponding vertical photographs about two inches on a nine-by-nine inch negative.

Successive exposures are taken along the line of flight at intervals to assure proper overlap of photographs to satisfy stereoscopic and control requirements of photographic mapping. Parallel flights are spaced approximately 25 miles apart. The standard scale is 1 to 1,000,000, which means that one mile on the ground is represented by approximately one-sixteenth inch on the map. An Army plane can photograph 20,000 square miles in three hours.

Giant Caliper Matches Tires To Prevent Excess Wear

Dual truck tires are matched with a gage that reveals fractional differences in diameter. Differences as small as three-tenths of an inch in rolling radius force the dragging of one tire over 93 feet of every mile traveled, causing excessive wear on both tires. Used like a caliper, the gage measures the tires without removing them from the wheels. It is scaled in one-eighth inch gradations.



Measuring dual tires on truck without removing them from wheels. Matched tires eliminate wasteful drag

Electrically Heated Air Suit Plugs Into Wired Shoes



Air gunner plugs in electrically heated battle dress

When a Yankee aerial gunner puts on battle dress, he is assured of freedom of action and plenty of warmth. His clothing is of lightweight cloth, warmed by current passing through veins of electric wire—much as your kitchen toaster's heating element is activated. Not even the gunner's feet are exposed to the frigid climes of the stratosphere, for his shoes plug directly into the "outlet" on the trouser cuff.

"Paper" Box Soaked 24 Hours Fails to Fall Apart

After being submerged in water for 24 hours, a paperboard box developed by the Du Pont Company not only held together but supported the weight of its contents. This weatherproof box is made of four to eight sheets of paper laminated together with a waterproof vinyl resin. The material can be shaped on standard fiberboard box machinery. Designed to meet government specifications for the shipment of vital materials overseas, the boxes can be stacked on open decks and stored in damp tropical warehouses.

Swelled by the penetration of water, wood is capable of exerting a pressure as high as 200 pounds per square inch.

2: 7: 11. 1382 7: 11. 1382 7: 11. 1382
 Chicago, Ill. 7/463

WAR WORK SET to MUSIC



Music on the job helps relieve monotony and fatigue. Employees form a band at General Electric plant (above) and workman sings at plant of Botany Worsted Mills, Passaic, N. J. (left)



MUSIC, with its power to relieve monotony and reduce fatigue, is helping workers to set war-time production records. In thousands of plants workers have a daily accompaniment of tuneful melodies brought to them over loudspeaker systems while they are at their tasks.

Plants where musical programs are broadcast to working employees are estimated to number more than 5,000, ranging from laundries and bakeries to arsenals and shipyards; from textile mills and tobacco factories to airplane and tank plants. Even a battleship, evidently, can be built more efficiently to music, for production records were established in the construction of the new 35,000-ton Alabama, during which workers on the job heard six concerts daily from phonograph records played through an amplifying system.

Successful use of music is by no means confined to war plants. Music and work have formed a partnership that apparently has come to stay. In a San Francisco experiment music was broadcast on all floors of a large office building. Employers and employees alike said music helped them work more smoothly and efficiently.

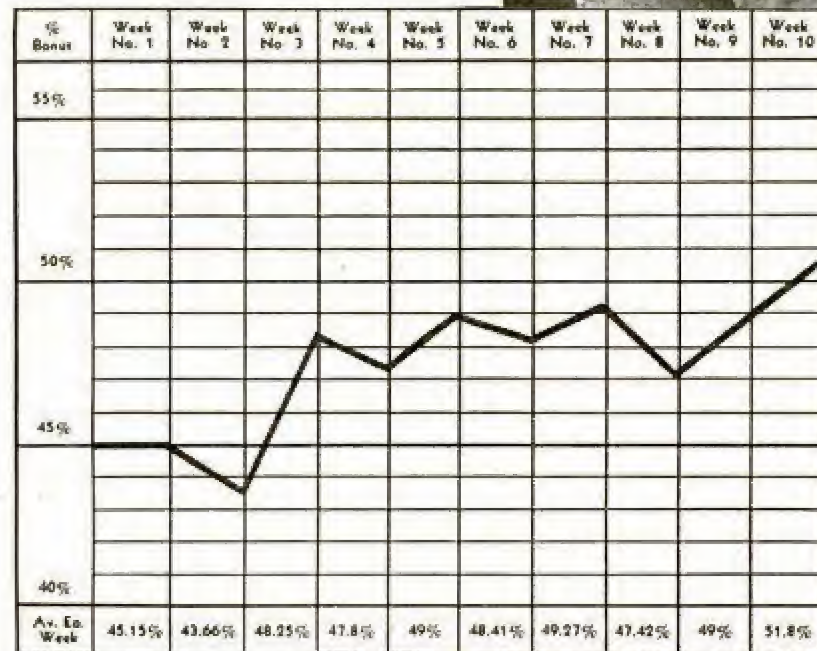
Several hospital operating rooms are wired for music, and reports are that surgeons and attendants do better and smoother work and the patients are soothed as well. The value of music to speed conva-

Copy: Operadio Wfky. C.
 St. Charles, Ill.

lence has long been recognized.

Industrial use of music is not meant to entertain, but to lessen monotony, boredom and fatigue. Music lifts the spirits of the workers, and even reduces accidents caused by tiredness. One works manager calls music a "mental vitamin" for his employees. Another says music reacts on factory workers much as "sea chanties" did on the crews of sailing ships.

"Home talent" shows are the order of the day in countless factories. They are broadcast at lunch hours, rest periods or at changes of shifts. And the amplifying systems, of course, are used for all manner of announcements, as well as im-



Music "piped" to workmen, as above, brings about such increases of work as charted, left. "Efficiency bonus" was paid for work above specific rating, so percentage of bonus reveals amount of work increase. Chart was compiled by Operadio Manufacturing Co. of St. Charles, Ill. Below, the control room in a General Electric plant

portant news events. In many plants, elaborate broadcasting studios are maintained. Some of them are large and theaterlike—suitable for staging amateur or professional shows for off-shift workers.

The same sound systems that bring music to the workers are used to page officials, supervisors or individual employees, the call message being superimposed over the music, which is reduced in volume but not stopped. One aircraft plant transmits some 3,000 paging messages daily over its plant system, thus saving about four minutes a call. Based on a supervisory wage of \$1.50 per hour (most calls are for supervisors), annual dollar savings are estimated at \$109,200.





Courtesy RCA Victor and Botany Worsted Mills

Circuit that transmits concerts may also be used to page persons, or to send out announcements

That musical programs actually do increase production is revealed in numerous studies. One series of tests by the Stevens Institute of Technology in 16 plants showed these averages, as reported by Harold Burris-Meyer, director of sound research of the institute, to the American Society of Mechanical Engineers:

After the inauguration of musical programs in the 16 plants, the average output in terms of units per employee increased 6.25 percent. The index figure of production rose from 301.2 percent before music to 335.6 percent after music. Early departures from work averaged 2.52 lost man-hours before music, and only .845 afterward. Monday morning absenteeism declined from an average of 22.75 percent to only 2.85 percent after the music was made a daily feature.

Information for these studies was compiled under the direction of R. L. Cardinell, industrial specialist of the Stevens Institute, who conducted much of his work under the auspices of the Office of Production Research and Development of the War Production Board.

What types of music are best adapted to plant broadcasting — classical, operatic, popular, band, "swing," or a combination? And how often should it be broadcast?

It is agreed that martial types of music are best for early morning, or at the beginning of a shift. Toward the end of a shift, or late at night, fast music, such as polkas, generally is favored. In between, there

seems no particularly outstanding variety.

Popular numbers, waltzes and semi-classical selections are used at intervals throughout the day. "Mixing them up" is a frequent method.

"Musical request boxes" are common in many plants. Younger workers like more popular music. At the East Pittsburgh plant of Westinghouse Electric and Manufacturing Company, in fact, girl employees in five divisions broke production records to such tunes as Tommy Dorsey's "Boogy Woogy" and Abe Lyman's "Amen." In some plants, college songs are played during the football season, and Christmas music during the holidays.

Music is not played continuously. Programs vary from 10 minutes each hour to six half-hour concerts per 24-hour day. In a typical instance, the Cluett-Peabody Company, Troy, N. Y., shirt makers, broadcasts daily to all departments from 7:45 to 8:00 a.m., from 10:45 to 11:00 a.m., and from 3:45 to 4:00 p.m., and to individual departments at several other 10 to 20 minute intervals in midmorning and midafternoon.

Perfection of loudspeaker systems of high fidelity is one reason music has gained favor in industrial plants.

Machinery noise at first was thought to be a drawback to music, but careful measurements of noise intensities, scientific placement of speakers, and control of volume make music as effective in riveting and pneumatic drilling departments as in the more quiet laboratories or testing di-

visions. It has been found that music will penetrate to the ears of the workers, even when the noise level is incredibly high.

One manufacturer of sound equipment for factories (Operadio Manufacturing Company, St. Charles, Ill.) answers the question, "How can music be heard over the noise of the machines?" like this:

"The problem is largely solved by having the loud speakers pitched according to the noise level in the various departments. The vibration frequency of the vertical-cut transcriptions is far higher than most of the factory noise, virtually fanning the sound-wave range audible to the human ear. And since the frequency

(Continued to page 150)



Photo above, courtesy RCA Victor and Botany Worsted Mills

Some like it sweet, some like it hot—both get their wish (above). Below, no matter how noisy the department, the music penetrates effectively



Beacon Trail Leads Battered Plane to Field

U.S. War Department
developed by British Anti-Aircraft

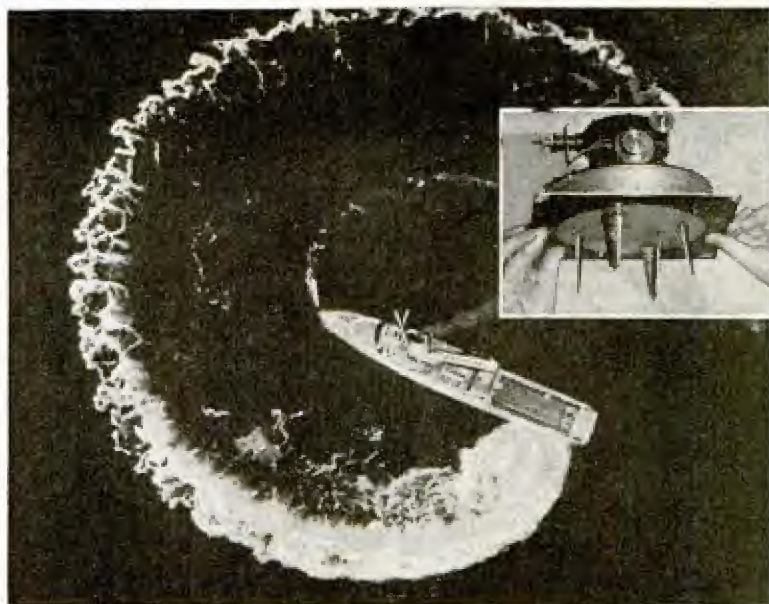
Bombers returning to England by night with their instruments—their “eyes”—shot away are led to the nearest landing field by a “road of light.” Arriving over the English coastline, the battered plane flashes word of its damage to searchlight crews. The light crew forwards the information to a control room, which plots a route to the nearest landing field. The first searchlight crew points its beam in the direction of the next searchlight along the route; the second light crew snaps on its beam when the plane arrives in its sector, and guides the craft to the next—and the procedure is continued until the plane is safely over the chosen field. In one night as many as 30 planes have been brought safely to base by this “homing beacon” service, perfected by the British Antiaircraft Command. Should a plane nearing an airfield be unable to find the landing strip, a circle of lights may be switched on, and by following it the pilot eventually comes to the strip.



7565

Propeller-Rudder Lets Ship "Turn on a Dime"

Ships may turn on the spot—with no forward motion—when equipped with a propeller to which the United States gained access when we entered the war. The patent for the Austrian invention, the Voith-Schneider propeller, was seized by the Alien Property Custodian. The propeller propels and steers a vessel simultaneously but independently. Altering the pitch of its blade will change the vessel's course from full speed ahead to full thrust astern, move it sidewise, or turn it around "on a dime," while the screw continues to act at constant speed and in the same direction.



Wake shows extreme maneuverability of ship with propeller-rudder in inset

Equipped with the propeller, a ship is free from such appendages as rudder and rudder stock. Advantages of such maneuverability in a warship are obvious, especially in an era when any vessel might suddenly

find itself under air attack. More than 50 German warships are understood to be fitted with this propeller, and U. S. Navy and Maritime Commission officials recently attended a demonstration of its operation.

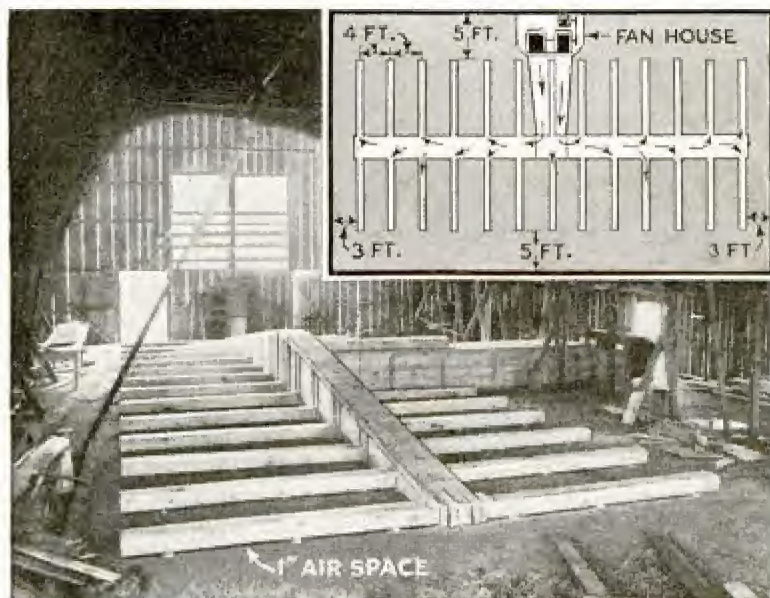
7521

Drier to Make Hay in the Rain Rests on Floor of Haymow

In rain or shine, farmers can cure hay in the barn with a drier consisting of a blower and a system of air ducts built on the floor of the haymow. Developed by engineers of the Tennessee Valley Authority, in co-operation with the Tennessee Agricultural

Experiment Station, the drier was used last year to cure more than a thousand tons of hay. The forced-draft system is laid out horizontally with a main air shaft and lateral vents. The laterals, arranged in pairs, are like rectangular feed troughs turned

upside down and raised about one inch off the floor to permit air to pass up through the hay. The size of fan used depends on the amount of hay to be dried. For best results, the engineers found the total depth of hay in the barn should not exceed 15 feet with not more than eight feet dried at one time. The blower is kept operating until the farmer finds that no warm, moist air is being blown from the hay. Experiments with alfalfa, clover, timothy, soy beans, barley, oats, and mixed field grasses have revealed that the barn-cured product is superior to hay that has dried in the field.



Air blown from fan (see inset) passes through main shaft to side vents

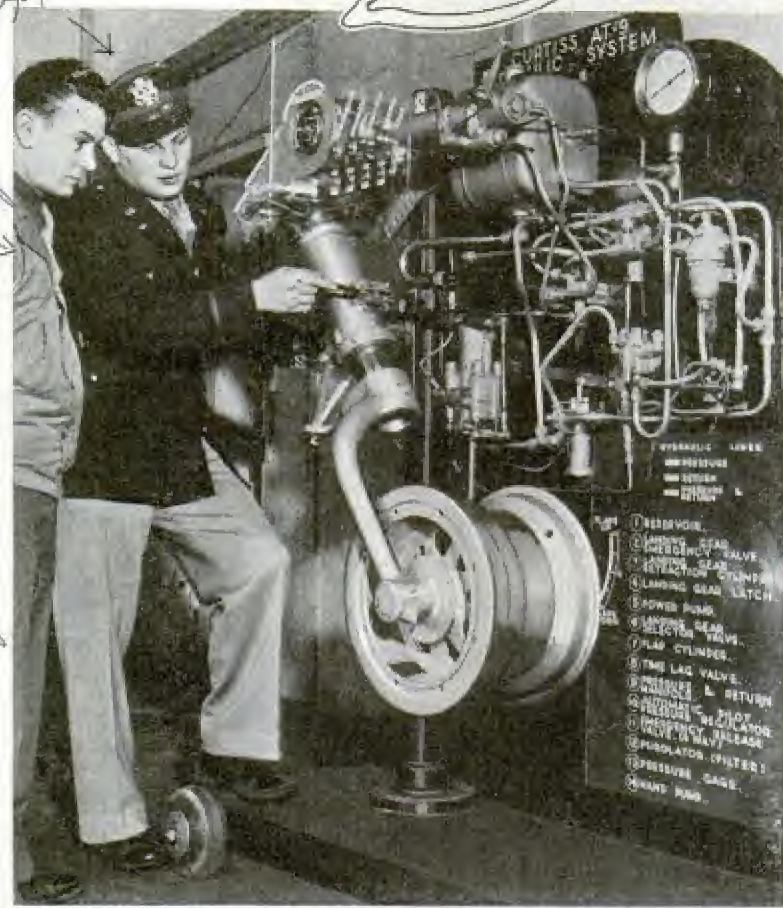
*Harry P. Bagley, 1848 - 41st St.,
Sacramento, Calif.*

SEEING is BELIEVING

7/28/

Lt. Dixon

Cpl. Lockhart 7. July



Transparent plastic and condemned plane parts make visual study aids for aviation cadets. Above, mockup of hydraulic system of advanced trainer. Below, duplicating instrument housing in Plexiglas; workings are visible

Private Jack Lohes



TRAINING aids built of scrap material and condemned airplane parts are speeding the ground school instruction of aviation cadets at Mather Field, an advanced flying school of the Army Air Forces Flying Training Command.

In the Mather Field Synthetic Training Aids Laboratory, Lt. Joseph C. Dixon directs the building of visual appliances that enable the future fliers and mechanics to look right inside aircraft parts and see how they work. The laboratory mock-ups are built of Plexiglas, fiberboard and other material.

Hydraulic systems for airplanes, various types of navigation instruments, and other aids to flying are also being produced in the laboratory.

Lieutenant Dixon conducts the laboratory under the direction of Maj. Joseph C. Terry, director of the Mather Field Ground School.

Because a high percentage of training accidents are traceable to faulty knowledge of the hydraulic system that operates the retractable landing gear and the flaps on advanced training planes, the laboratory's initial effort was a mock-up of the hydraulic system.

Students formerly viewed the various parts of the system by studying an airplane mounted upon blocks, supplementing this makeshift procedure with a perusal of charts and diagrams.

The new mock-up condenses the system into a mobile, working model, readily demonstrating the relationship of the fourteen principal working parts. The visual mock-up permits as many as 50 students to study the system simultaneously, accomplishing in one hour

what formerly took five or six.

The hydraulic model is activated by a small, electrically driven pressure pump. It demonstrates the automatic and the two manual operations pilots can use to drop a plane's retractable wheels into landing position.

"In studying the hydraulic mock-up," Lieutenant Dixon explained, "the student pilot opens the landing gear selective valve and opens the time lag valve, just as he does in his training plane. Hydraulic pressure pushes the landing gear to the 'down' position. When the student pushes the landing gear selective valve on the mock-up, he can actually watch the mechanical operations which ensue.

"In case there is no pressure—for example, if a pressure pump were put out of operation—the pilot presses the landing gear selective valve and pushes the time lag valve as before, then works the lever of a hand pump to supply the hydraulic force necessary to force the wheels into landing position.

"In case the normal hydraulic system is inoperative by reason of a broken bit of tubing, or a bullet-riddled valve, the pilot can switch to an emergency system and pump the wheels down manually. Each of the operations is clearly demonstrated on the hydraulic mock-up.

"Visual study provides many shortcuts and eliminates many hours of poring over books and diagrams."

None of the equipment used in the synthetic training aids laboratory is good enough for use in a plane. Most of it is badly worn and has been condemned.

A featherweight communications system for a primary training plane consisting of a battery, an amplifying tube, a few feet of wire and a container, has been developed in the laboratory and now is in use on planes at Mather Field.

The new apparatus supplants a "speaking tube" arrangement into which the instructor bellowed at the top of his lungs, in a futile effort to compete with the roaring motor and the whistling wind.

Private Leo H. Brown of San Francisco, who dabbled with slot machines, pin tables, juke boxes, radios and other intricate mechan-

(Continued to page 148)



Suction from vacuum cleaner activates gyroscope compass, top. Below, featherweight instructor-student communication device



Smith & Wesson Co., Hartford City, Ind.

71507

Glass Box Shows at a Glance What Postman Has Left



Properly mounted, mailbox can be seen from indoors

Going outside to fumble with the mailbox to determine whether the mailman has come is an age-old ritual with most householders. With a glass letter box this trip can be avoided, as a glance out the window at the transparent container will show whether there is any mail. It is made of heavy glass mounted on a plywood frame treated against moisture and termites.

It Isn't the Humidity, After All —It's the Relativity

In "sticky" weather, it's not so much the humidity as it is the "relativity" that makes you uncomfortable. Humidity is a relative term and the degree in which it exists depends on the temperature. Hundred-percent relative humidity—found only in a Turkish bath or a tropical rain forest—is where the air at a given temperature cannot absorb any more water vapor. But if this temperature should rise, say from 90 degrees to 100, the relative humidity would no longer be 100 percent. The warmer air would be able to absorb more moisture, so the relative humidity would drop a few degrees. Also, if relative humidity in the

desert is 20 percent at 95 degrees, and the temperature should fall to 80, the percentage of water vapor would rise. In other words, the same roomful of air can be either "dry" or "damp" depending not on how much vapor is in the atmosphere—but how much vapor is present at a certain temperature.

71597

Error Leads to Better Radiator For Fighter Planes

An error by a Binghamton, N. Y., collar-button manufacturer 40 years ago had as one indirect result the development of the type of cooling radiators now used in most American fighting planes. The manufacturer, wishing to make aluminum snap buttons, made one punch somewhat long, and was amazed to discover that it produced, instead of a flat button, a long aluminum tube. Under pressure the soft metal had flowed through the narrow opening between the punch and the sides of the tube. He had come across the technique of extruding seamless, thin-walled metal tubes. Tubes made by this process, as at Winchester Repeating Arms Co., form the honeycomb of radiators used in liquid-cooled planes. The radiator shell is filled with 26,000 such tubes, in the cartridge-core radiators. Expanded ends of the round tubes are made hexagonal, so they lie closely together at every point of contact, and can be soldered together into one compact group. The coolant does not flow through the tubes, but around them. Air flowing through the open ends of the tubes cools the liquid.



Honeycomb of tubes forms liquid-cooled plane radiator

Pontoon Tow Bridge Is Gate to Farm Shipyard

When the Odenbach Shipbuilding Co. set out to build oil tankers for the Transportation Corps, Army Service Forces, at Greece, N. Y., it was impossible to obtain frontage on Lake Ontario. So the company set up shop on an inland farm site, about 1,800 feet from the lake, but abutting on a pond from which an exit channel to the lake was dredged. Still, sending the vessels down the channel for a shakedown cruise would interfere with traffic over a nearby road. A drawbridge of sorts was called for—an economical one, that could be set in place in a hurry, and could still be swung aside to permit the vessels to pass. With the help of engineers of the Irving Subway Grating Co., an unusual type of span was built. It is a "pontoon tow" type, 65 feet long and 22 feet wide, with four lifting pontoons, one under each corner, and four outrigger pontoons for added stability. The bridge, which is about 200 feet back from the lake front, rests on a continuous concrete sill. When a boat is to sail through to the lake, a portable air compressor mounted on a truck pumps pressured air into the bridge's lifting pontoons, emptying out the water. The span then rises several feet above the



Portable air compressor on bridge, top, inflates pontoons, and entire span is swung into an especially dredged bay, allowing vessel to pass

roadway level, and is ready for the tow-lines. A team of two men operating from the roadway can swing the entire span about 50 feet, to sidle it into a specially dredged bay, while the tanker passes. Inflating the pontoons and moving the bridge consumes 20 minutes or less.

Jeep With Overhead Exhaust Pulls Amphibious Trailer



Jeep and trailer are waterproofed; overhead exhaust resembles periscope

As a companion to the seagoing jeep, an amphibian trailer has been designed. It carries a quarter-ton load, trundling behind the jeep on either land or water. Vital parts of the jeep and of the trailer are waterproofed with special sealing materials. The sea-jeep has been fitted with an overhead exhaust, resembling a periscope.



This little fellow has what is valued at a king's ransom—perfect sleep. The secret is learning to relax

THE three essentials of all animal life—including the human variety—are food, drink and sleep. While food may still be obtained in sufficient quantities and some kinds of liquids are always plentiful, wartime insomnia is rapidly growing to the point where it is attracting a lot of scientific attention.

The mystery of sleeplessness is as old as civilization itself, for the development of civilization was accompanied by the nerve-racking tensions that brought about insomnia. Even before the war, millions of Americans considered lack of a good

night's sleep their greatest problem. The output of sleep-producing medicines broke previous records in the United States in the year before Pearl Harbor. Thousands of sleep-inducing gadgets had been devised. One department store in New York City, the nervous-breakdown center of the nation, devoted an entire floor to a "sleep shop."

With the war came dozens of new sleep destroyers, such as casualty lists, rationing, higher taxes, disturbed habits, shortages, business upsets and air raid alarms. One of the prime factors in the menace of absenteeism in war plants has been a lack of refreshing sleep, particularly on the part of night workers disturbed by daytime noises and disrupted routine.

An up-to-the-minute survey of the latest flood of theories concerning the mystery of sleep and why some people fail to obtain it in a normal manner indicates that it is by no means necessary to try one remedy after another. One basic theory advanced by physicians and scientists seems to fit

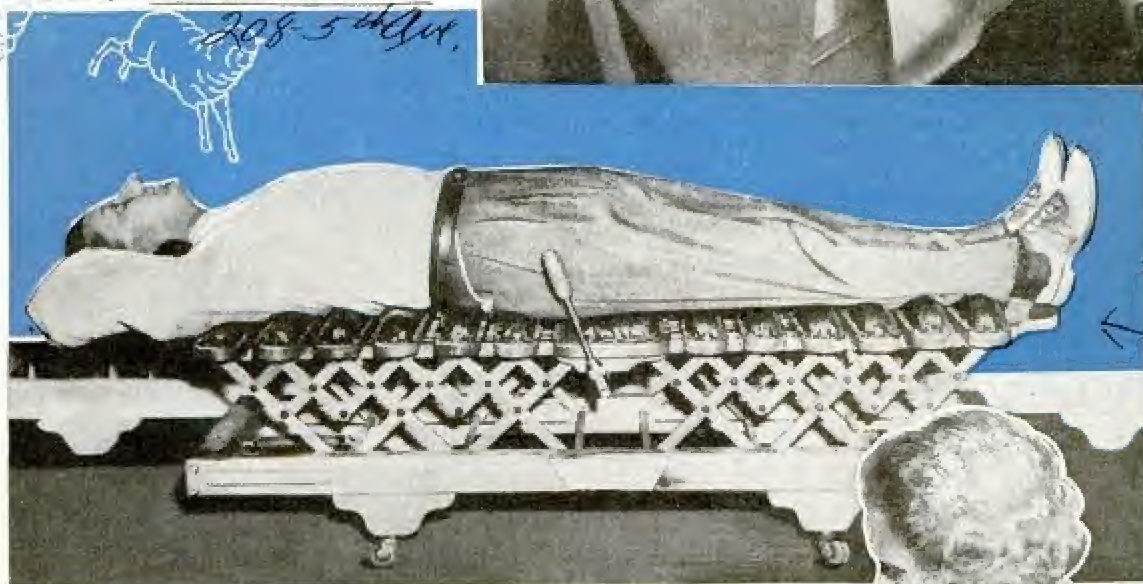


Photos by
Courtesy of Whittlesey House
Tiny platinum wires pierce muscles to record the relaxation

most of the insomniacs. It works out like this:

Sleep is the natural and healthy temporary suspension of consciousness and activity, recurring naturally once every 24 hours and lasting around eight hours. It is accomplished when the brain discontinues much of its activity while at the same time the normal voluntary and muscular activities are halted. Formerly it was believed that the brain is in complete command and that the nerves and muscles subside in their activities accordingly. But the relations are not so simple. There is every reason to believe that the brain is kept

Sleep aids include bedside bag (right) holding handkerchiefs and other items
Courtesy of The Hobart Co., New York City



active only if messages keep coming to it from the muscles and nerves. When these messages diminish in number and frequency, as generally occurs when we lie down to sleep, the brain becomes less active. Then it sends fewer messages via the nerves to the muscles. The result is the reverse of a vicious circle, and ends in normal sleep. Insomnia is present if messages continue to flow actively to and from the brain via nerves.

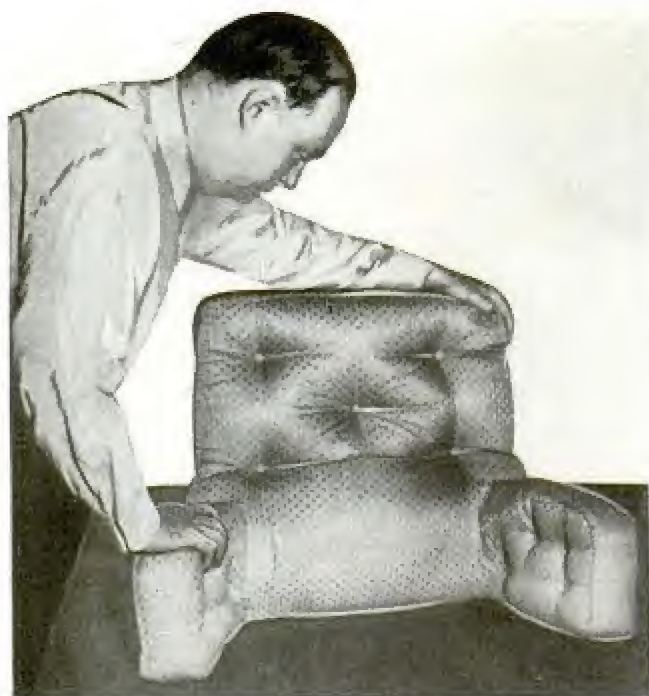
When the brain fails to become sufficiently quiet for sleep, it may be induced to do so by quieting the nerves and muscles. Relax the muscles and this will relax the nerves. Relax the nerves and this will relax the brain. Relax the brain and—presto!—the brain

Above, Relax-o-Cot has grooves for heels and neck with handle to stretch body, relieving tension. Bed lamp for two (below) does not glare in sleeper's eye
Photo from
Lewis & Conger, New York City



Frank, Calver with
1185 N. Highland Ave.
Atlanta, Ga.

Div. of Muscular-Relax. Book Co. Inc.
330 W. 42nd St.
N. Y. C.



This deluxe backrest is for bed readers who like to read themselves to sleep in a position that won't strain eyes

throws the switches and puts you to sleep.

Dean of the muscular-relaxation school is a Chicago physician, Dr. Edmund Jacobson, who has written a book called "You Can Sleep Well" (Whittlesey House) out of what he learned in laboratories of the University of Chicago and since 1936 in his own Laboratory for Clinical Physiology.

For the purpose of performing tensions in bed to bring about relaxation, he divides the body into five sections, arms, legs, chest, eyes and throat, the latter including all of the muscles of speech. The idea is to tense each section deliberately and then relax it deliberately, repeating the tension until each section will automatically relax when you go to bed without being tensed.

In the case of the arms, he suggests you hold them in the air with fists clenched for a minute or so, then relax the fists and drop the arms "like those of a rag doll." For the legs, he advises bending down the toes, then relaxing and stretching the heels. For the chest, he advises taking a deep breath and letting the air find its own way out of the lungs. For the eyes, it's turning them to one side and letting them settle back into relaxed position. For the organs of speech, count silently for a while and then stop and relax the tongue, throat and jaw.

He adds some interesting "don'ts." Don't try to relax, for this brings tenseness. Don't make a practice of discussing any topic or chatting while in bed; instead, reserve the

lying down posture for sleeping. And don't expect the habits of a lifetime to change overnight; some persons require a year of relaxation discipline, although these are extreme cases. The chances are that if you can learn to relax completely for as long as 30 seconds at a time, you will fall asleep.

Many variations of the same theory of muscular relaxation are advocated by other experts on the subject. They all recommend stretching of the muscles and then letting them go limp. For example: lie on your back, bend a knee and clasp it with the hands, pulling with the arms and pushing with the knee. Then drop arms and leg. Or, kneel in bed and bend forward, stretching out the arms as far as possible. Or lie prone in bed and stretch arms wide and legs down as far as possible. Then relax.

The advocates of a "warm bath before going to bed" have the same object in mind, muscular relaxation, but suggest heat to bring it about.

They also point out that a warm bath draws the blood from the brain to the tissues near the skin. This lessens the blood supply in the brain and causes it to relax. A bedtime snack also draws the blood to the stomach and out of the cranial cavity, providing of course the snack is only a snack and the food is light and easily digestible. Unfortunately, advocates of the heat and snack



Inducing sleep by stretching arms with fists clenched, then dropping them limply on bed like rag doll

theories have not subjected them to laboratory tests.

Extremists of this school suggest that to lessen the flow of blood to the brain it is helpful to wear a pair of wet socks to bed, especially if it is summer or the room is warm.

Apparently working on the opposite theory from those who believe the blood must be drawn from the brain, are those experts who suggest reading in bed to bring about somnolence. Wide support of this theory is indicated by the large sale of ornate back rests with which the bedtime reader can be comfortably propped up. All agree it is injurious to the eyes to read on one's back and either a back rest or a couple of pillows should raise the head and shoulders. So large has this group of "bed readers" become that books of a pleasant, quiet nature have been specially written to relax the mind. The variety of trick bed lamps on sale is huge. One lamp is a double bull's-eye affair devised so that either of two persons in bed can read without casting a light into the other's eyes. These views, also, are not supported by laboratory tests but result from trials made by individual authors who do not sleep well.

Research into the mechanism of sleep has occupied millions of hours of inquiry. Dr. Jacobson's laboratory has made thousands of moving pictures of dial readings on complicated electrical machinery arranged so that it is put into operation by the muscles of human "guinea pigs" as they fall asleep.



Young model (top) is completely relaxed and will drop off to sleep in a jiffy. Lower view, legs crossed, arms under head will keep her awake

To activate the machine, the person being tested is made comfortable on a couch in a sound-proofed, electrically insulated room, and tiny platinum wires are inserted painlessly through the skin to the muscles around the eyes, the mouth or in the arms. Muscular tension is registered on a fluttering wire, the shadow of which is photographed. The film charts can be timed and read and the gradual relaxation traced until sleep comes. The results of these tests seem to bolster the "muscle and nerve" relaxation theory.

Dr. Joseph L. Fetterman of Western Reserve University, Cleveland *Ohio.* recently supported the idea (suggested years ago by a Swiss scientist) that the mechanism of sleep is located in the hypothalamus, a stalk in the lower part of the brain where control is executed over the involuntary body operations. He advances the

Here's a pillow test. Sagging pillow shows "dead" feathers





Courtesy of the Sleep-Shade Corp., San Francisco *425 Bussell*
This eye shield for the war worker on the night shift rests light as a feather on forehead, nose and cheek and does not touch eyelids

thought that this section of the brain regulates the metabolism, or burning rate, of the food which is converted into fuel, and that sleep is principally a lull in the metabolism, or a "banking of the fire" in the body.

The hypothalamus, he believes, also acts as a thermostat, using the water intake and outflow, as in perspiration, to regulate the temperature at a point necessary for comfortable sleep.

The theory that body temperature affects the ability to sleep restfully is generations old. Benjamin Franklin believed that body temperature under the covers was the principal cause of insomnia. He used four beds, changing from one to the other throughout the night to lessen the accumulation of body heat.

Experiments were made recently by the U.S. Army Medical Corps at Fort Knox, Ky., where soldiers were kept days in rooms varying from 30 degrees below zero to 120 degrees above. In the lower temperatures it was found that men could not

sleep regardless of the type of insulated bags furnished, being forced to arise again and again during the night to run around the room and raise the body's metabolism rate before they could go back to sleep.

Recognition of the fact that temperature and metabolism have a definite effect on the ability to sleep was given by General Electric Company scientists when they developed the "automatic blanket" which is heated by electricity and is so arranged that a bedside switch will regulate the temperature under the covers. These blankets are still being sold, particularly to persons who were affected by fuel oil shortage.

In view of Doctor Jacobson's studies, we now can understand why people fail to sleep if cold. The skin sends messages to the brain and the brain sends back messages to the muscles, making them tense, in what is known as shivering. We shiver in order to become warmer. Under these conditions with messages going to and from the brain via the nerves and muscles, the whole nervous system is tense, in other words, wide



Left, clips keep covers in position and sleeper snug. Below, rubber ice pack made to fit into refrigerator

Photo from Merchants & Manufacturers Co., Springfield, Mass.



awake. If warmth is applied where needed, the messages and the shivering subside and conditions become more favorable to sleep.

It is estimated that more than 700 separate sleep-inducing items are on sale and sleep gadgets sell into the millions of dollars yearly. One is a "relax-o-cot" in which the heels and neck are hitched in grooves and a lever enables the owner to stretch not only muscles, but the spine, as well.

Among the most popular devices are seven- and eight-foot beds for tall folks who cannot stretch out in ordinary beds, others just as wide for those who like to "spread out" while sleeping, mattresses of sponge rubber which fit the contours of the body, mattresses with coil arrangements serving to keep two persons from rolling into the middle of the bed in case it sags, pillows with concave curves so they do not hunch under the shoulders, eye-shades which exclude light, screens which may be placed in windows, shutting out noise and light but permitting air to circulate, and humidifiers that keep the atmosphere of the bedroom moist.

Others include a Lullaphone which, at the turn of a switch, hums a constant drowsy tone to distract the mind, lullaby records to play on a phonograph, heat pads and vibrators.

Novel, too, are luminescent stars which may be pasted to the bedroom ceiling so that they glow after the lights are turned out, tiny night lights which allay the fears of the nervous, rubber ice packs which may be cooled in the refrigerator and applied to the head, or pillow.

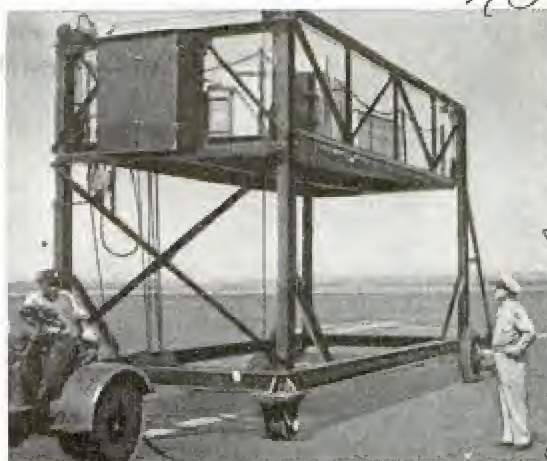
There are night caps which strap under the chin to eliminate snoring, and rubber balls which may be pinned to the back of one's pajamas, awakening the person who snores when sleeping on his back.

The bed and its springs and mattresses have a great deal to do with the rest of people who ordinarily give no thought to insomnia. Priorities are certain to have an effect on the sleep habits of the nation, for all types of mattresses and springs depending on metal are out for the duration. Literally thousands of substitute devices depending mostly on the springiness of wood slats, cotton rolls, and rope are being rushed to market.

Certainly, since the nation's millions cannot carry on the work of war without plenty of rest, solving the mystery of sleep will become a more important problem. But it appears that if each person tries to find some gadget to fit his particular case, he will pursue the will-o'-the-wisp. Only if you learn to relax will you sleep soundly, even under unfavorable, noisy conditions.

DECEMBER, 1943

Elevator for Cargo Planes Lifts 10,000 Pounds



Tractor (top) speeds elevator to cargo plane (below)

Loading of cargo planes is made easier and faster with a portable elevator that adjusts to heights varying from 22 inches to 12 feet. The elevator platform is raised by a five horsepower motor that can lift 10,000 pounds, a maximum load for most planes. A roller-conveyor carries the cargo aboard ship. The elevator, developed by the 39th Air Freight Wing Detachment at the Newark Army Base, Newark, N. J., is moved by small tow tractors.

300,000 Lives Saved Since 1913 When Safety Work Started

Steady improvement of the accidental death rate since the national safety movement was inaugurated in 1913 has resulted in a saving of 300,000 American lives. In 1913 the fatal accident rate was 85.5 per 100,000 population, and last year it was 69.3. Every year the rate has been lowered, with the exceptions of 1917 and 1936. The total of accidental deaths in the 30 year period was 2,707,000, according to National Safety Council figures in its yearbook, "Accident Facts." Had the rate been as high each year as in 1913, the dead would have totaled 3,004,000.

National Safety Council
20 No. Wacker Dr.
Chicago, 6, Ill.

Commanding Off. of the Detachment, Philip A. McGriff, 3-21-11
Developed by Capt. John A. Rowley, 3-21-11
Newark Army Base, Newark, N. J., 3-21-11

Thomas B. Stinson, Jr. 3872 Franklin Ave.
Los Angeles, Calif.

71426

TASK FORCE... *The PICK of the FLEET*



The crew of a carrier stands by ready for action as a Navy warplane awaits starter's signal to take off for a flight. Below, a yeoman records message as a signalman reads a blinker signal through the "long glass"



THE JAPS were up to something and Admiral C. W. Nimitz, Commander-in-Chief of the Pacific Fleet, was aware of it.

Jap cruisers and destroyers were being withdrawn from the South Seas. There were reports that as much as half of the enemy's fleet was gathering, obviously for a large scale attack.

Alaska? Hawaii? The West Coast? Admiral Nimitz had to decide on the most likely target, then send out ships to stop the attack. He grouped several carriers, cruisers, and destroyers into a task force and sent them west. The Japs came on—

then broken up and their units regrouped into other task forces. Our two ocean fleets are really ranging the seven seas.

There are undoubtedly task forces at sea today, but you will not hear a whisper about them until their jobs are completed. Often such a force makes rendezvous at sea, the ships gathering from possibly half a dozen ports and sailing under limited orders so that not even a captain knows what his next step will be until he has completed his present instructions.

If the voyage is to be a long one a Navy tanker may have been sent out some time

battleships, carriers, cruisers, and transports, 70 ships in all. We found them, and our flyers bombed a good portion of the fleet out of existence.

That was the battle of Midway, a good example of the naval technique America is using today.

Technically we have a Pacific Fleet and an Atlantic Fleet. Actually, neither of these two groups of fighting ships may ever assemble into one great armada. Instead, large or small groups are put together for special tasks. These task forces go to sea, perform their duties, and are

before, to refuel the ships in mid-ocean. Weather forecasts help decide the route and schedule that the task force will follow. With long range scouting planes being used by all sides, a task force likes to move under a canopy of clouds to lessen the chance of detection.

No two task forces are alike. Depending on the job it is to do, the distance it must travel, and the probable opposition, a task force is tailor-made to fit the work in hand. A force on convoy duty may consist mostly of the new destroyer escort vessels that are deadly against submarines. Another task group, put together to raid a Jap stronghold, obviously will contain a few cruisers or even a couple of battleships that can throw heavy shells ashore, and a number of aircraft carriers whose bomber and torpedo planes will be used for offense, whose fighters will protect the ships themselves from air attack. A submarine or two may have been sent into the area ahead of time to spy on the enemy and report his strength.

Meanwhile, other fighting ships are kept in reserve. An enemy threat might develop at any time and enough ships must be available at strategic points to put to sea on short notice to beat off such an attack.

This kind of naval fighting, rather than the massed-fleet tactics of tradition, is influencing the types of warships that America is building today. Naturally, present emphasis is on



A Navy decontaminator stands by for a gas attack
U.S.S. Oklahoma seen from sea-plumed California





U. S. Navy photos

A Grumman torpedo bomber is hoisted aboard a carrier from a Navy dock

aircraft carriers. Secretary of the Navy Knox has announced that the number of carriers, large and small, being completed this year will multiply by many times our total carrier strength at the end of last year. Dozens of slow but useful auxiliary carriers are in action already. These new auxiliaries are 487 feet long and are topped by 514-foot flight decks. Some are converted merchant vessels, others have been built expressly for the service. They are used not only as floating bases for wheeled aircraft but also to transport planes to within short flight distances of combat areas. The planes then take off for the final lap of the delivery trip, armed and ready for action. Many of the planes operating in North Africa were ferried across the Atlantic this way.

Another new vessel is the destroyer escort. These DE boats are 300 feet long, 35 feet wide, with a displacement of 1,300 tons. They are somewhat larger than a British corvette and their armament against aerial, surface, and subsurface raiders fits them ideally for convoy work.

Our fleet was nearly doubled in size this year. The tonnage of new warships completed in 1943 will amount to two-thirds of the entire American fleet as it

existed last year. Auxiliary vessels will be doubled in number, Navy combat aircraft are being trebled, and fighter types multiplied by five.

In our new ships, the naval architects have tried to foresee the future. One improvement, for instance, is the increased ability of a battleship to beat off enemy planes. Our battlewagons today have 100 times the antiaircraft fire power the "heavies" had in 1940.

Some radical suggestions for future types of warships have been made, based on the present ascendancy of aircraft. Architects anticipate that sometime in the future

our Navy will consist of sleek, low, turtle-backed ships with clean rounded decks that would offer little resistance to the sweep of the seas. Horizontal armor, rounded deck houses and turrets, and scores of antiaircraft batteries would help reduce the danger from enemy planes.

In fact, the damage that can be done to the guns and fire-control mechanism by a few well placed bombs has led to a number of revolutionary proposals. It is suggested that a ship's large guns be retracted inside their dome-shaped turrets during a bombing attack to avoid damage to the barrels. Another idea is that range finders and other detection and sighting mechanisms



Off duty but always on call, pilots lounge in ready room of an escort carrier until the order comes: "Pilots, man your planes!"

that are usually mounted in the superstructure be placed on elevators so that they can be raised into place for use, then lowered below the armored decks when not in use. Even searchlights would be retractable to avoid blast and splinter damage.

The stack from the fire room, instead of being an unprotected vertical opening straight into the bowels of the ship, might be armored and bent over so that it lies horizontally on deck. One suggestion is that this horizontal stack might then serve as a catapult runway for aircraft.

Rudders and propellers are sometimes damaged by near-miss bombing or torpedo attacks and a proposed solution for this might be an auxiliary means of propulsion that consists of high pressure streams of water ejected from under the stern for both steering and moving ahead. This would allow a ship to travel and fight in spite of underwater damage.

A coastal battleship, smaller than the capital ships, of shallow draft, may emerge as a new special purpose vessel to protect an invasion force right up to its point of landing. Deck armor might be as thick as 15 inches. It might have 15-inch retractable main batteries, a hangar for collapsible aircraft that could be catapulted along the runway on its horizontal smokestack, and



Incendiary tracer shells pour from the barrels of these high-powered 20-millimeter antiaircraft guns in practice on flight deck of a carrier

would be studded with antiaircraft guns.

Aircraft carriers may split into two distinct types. The big carriers might have two flight decks, with a sort of treadmill accelerating runway on the upper deck to facilitate getting heavily loaded bombers into the air. The carrier-cruiser might be a smaller type armed with 10- or 11-inch guns for offensive action, with a single-deck accelerating runway for planes.

Another new special-purpose craft is the antiaircraft destroyer, literally a floating pincushion of antiaircraft guns.

These suggestions indicate what our warships may be like in the future; meanwhile, the American Navy has found no foe that can't be whipped.

U. S. Navy aircraft escort the heavy cruisers of a "task force" on maneuvers off the California coast



71586

Lighted Training Ringsight Uses Photographic Film



Cheap training ringsight duplicates that on Spitfire

Built at one-tenth the cost of the official combat sight is a simplified aircraft training gunsight, used to train student Navy pilots in the art of blasting Axis planes. The sight, built by the American Optical Co., consists of a 15-inch-long cylinder containing a light source, a photographic film of target rings, and an optical system of two easily ground lenses and an unsilvered plate glass mirror through which the pilot looks. The target rings reflected on the mirror permit the flier to line up his target accurately. It duplicates the performance of the Spitfire combat sight. It can be adjusted to meet simulated conditions of night-flying, or glare. It will be installed on Navy training devices simulating actual combat flying by means of a light beam gun and a toy target plane that constantly changes speed and altitude.

Bombardier's Perspective Map Is Bird's-Eye View of Target

To a navigator or bombardier, approaching a target at a height of five miles and a speed of three miles a minute, a few seconds' hesitancy in recognizing landmarks may make the difference between a hit or a miss. Because this is especially true of U. S. bombardment crews, specializing in pinpoint accuracy, a new type of map had

to be designed, so that the crewmen would be able to spot their target in time to drop their bombs, sometimes from five miles distant. A perspective target map was developed, printed in four colors on a sheet 32 inches square, showing the target in the center. Such maps give only the details and terrain features that can be recognized unhesitatingly from the air. Such highlights as railroads, rivers, bridges and lakes stand out prominently. The center map is surrounded by perspective drawings of the target area from six different approaches, so that flight leaders have an option of bombing runs.

Snap Gage for Checking Threads Combines "Go-No Go" Limits

A thread roll snap gage combines "Go" and "No Go" limits for rapidly checking male threads to both maximum and minimum in one operation. The gage consists of a frame similar to an ordinary snap gage, in which two sets of gaging rolls are mounted, each roll being free to rotate. One set represents the "Go" limit, the other the "No Go" limit. Such gages are widely used in aircraft, ordnance and automobile work, for such inspection jobs as checking aircraft studs and various critical threaded parts. They not only check the assembly of male threads with female threads, but also assure uniform interchangeability within prescribed limits. In addition, they reveal specific inaccuracies, so that steps can be taken to correct the tool or machine at fault.



Snap gage checks threads to maximum and minimum

POPULAR MECHANICS
Springfield & Thomas
Sheffield Corporation
Dayton, Ohio.

Southbridge, Mass.

Thomas C. Stinson, Jr. 3872 Franklin Ave.
Los Angeles, 27, Calif.

71592



SOUTHERN PACIFIC'S crack overnight passenger train between San Francisco and Los Angeles was dimmed out as it made time along the edge of the Pacific. Headlight and engine lights were "visored" from above, the fire box was shielded to prevent stray light flashes, and curtains were drawn on the windows of every car.

Miles ahead, the engineer could see the subdued lights of the next town and as he watched, these lights began to blink out. The town went dark.

"Black 'er out, Jim," he called to his fireman. "There's an air raid alert."

The fireman reached for his fuel feed valve and gave it a couple of turns. Almost at once the engine's long plume of white smoke darkened into a black smudge that blended with the night. Storm curtains went up in the cab and the headlight was dimmed. Blacked out, the train kept on its way.

Keeping traffic on the move during blackouts is hardly a sentence in the book of how America's railroads are winning their part of the war. With a minimum of delay they are transporting 2,000,000 soldiers per month, delivering more than 4,000 cars of export freight a day to waterfront terminals, handling 10,000 cars of military supplies in and out of training camps every 24 hours, and are delivering some 40,000,000

Waving sooty plumes of defiance at the Axis, Santa Fe locomotives speed war loads over tracks. Below, adjusting a dim-out hood on Southern Pacific engine





Boilermakers performing "major operation" on big locomotive

gallons of oil per day into the East. In all, they are moving twice the ton-miles of freight and more than triple the passenger-miles that they did in 1939.

Freight traffic is 55 percent heavier and passenger traffic is up 24 percent over the peak year of the first World War, and yet the railroads are doing their job with 22,000 fewer locomotives and 600,000 fewer freight cars than they possessed in 1918. This seeming miracle in transportation is a good example of private industry's part in the war.

It's true that modern locomotives are more powerful and can haul

heavier loads than could the best engines of 25 years ago. That's a part of the story of how the iron horse has increased his horsepower. It's true, too, that by putting bigger loads into every freight car you can make few cars do the work of many, and yet that isn't the whole secret. The answer to how it's being done is pretty complex, but fundamentally it is that every man, woman, and piece of equipment on the railroads is working at full efficiency.

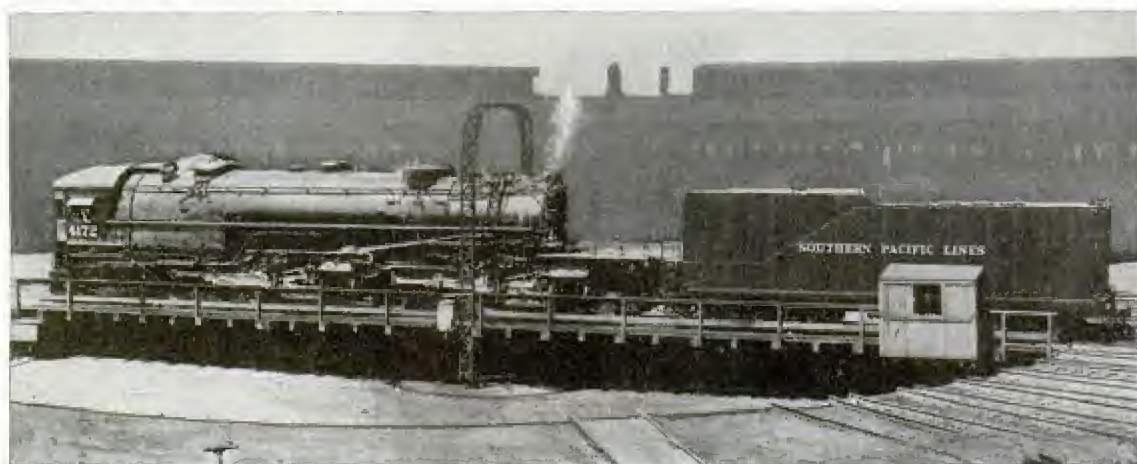
For background we might visit the Southern Pacific system, whose 2,100 engines piled up a total of 91,000,000 miles on its 12,800 miles of track in 1942. S.P.'s main lines extend from Portland to Los Angeles, from San Francisco to Ogden, and from Los Angeles to New Orleans. One of its affiliated

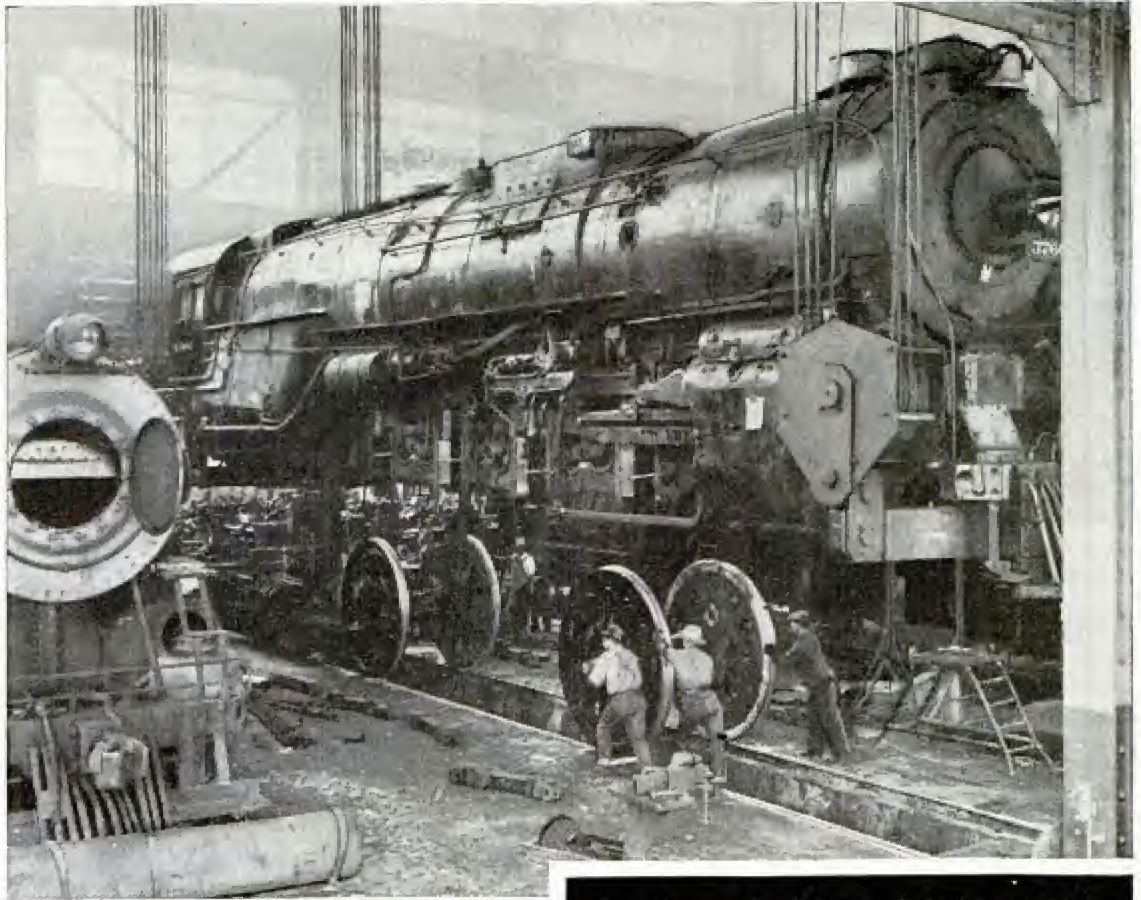
companies operates from Nogales, Ariz., to Guadalajara, Mexico.

Not until you visit such a railroad's shops



This 39-year-old engine has been streamlined. Below, locomotive rides a turn-table





do you begin to get an idea of the organization that backs up every engineer at the throttle of a locomotive. Southern Pacific's shop at Sacramento, one of many on its lines, employs 3,600 people and spreads over 180 acres of shop grounds.

Here, in the locomotive department, an average of one big engine every two days is put back in service, repaired and ready to roll. Many parts for locomotive repairs can be manufactured on the spot. Until 12 years ago Southern Pacific built many of its big passenger engines in its Sacramento establishment and has also built some of its rolling stock, including box cars and gondolas.

Facilities such as these help the S.P. do two things that are vital for the wartime speedup. Like every other American road, the system has had to cram more hours into every 24-hour day and it has had to create locomotives out of thin air. Each is being done.

Putting more hours into a 24-hour day means taking up every

Top, rolling a renewed set of driving wheels under a locomotive in the Santa Fe railway shops. Below, inspecting a journal with magnifying glass





Over mountains, deserts and plains, the freight must be kept rolling. Here a Southern Pacific freight is entering snowshed

minute of slack in traffic schedules so that engines and cars remain in service more continuously. Even such a device as reducing the number of stops for a heavily loaded freight makes a big difference in its running time due to the many miles that a freight often uses in getting up to operating speed after a stop.

Creating engines out of thin air sounds tough until you learn how it's done. The thing is, every locomotive has to go into the shop, periodically, for maintenance and overhaul. A heavy freight engine may go in for maintenance every 60,000 miles and a big passenger locomotive may be due for

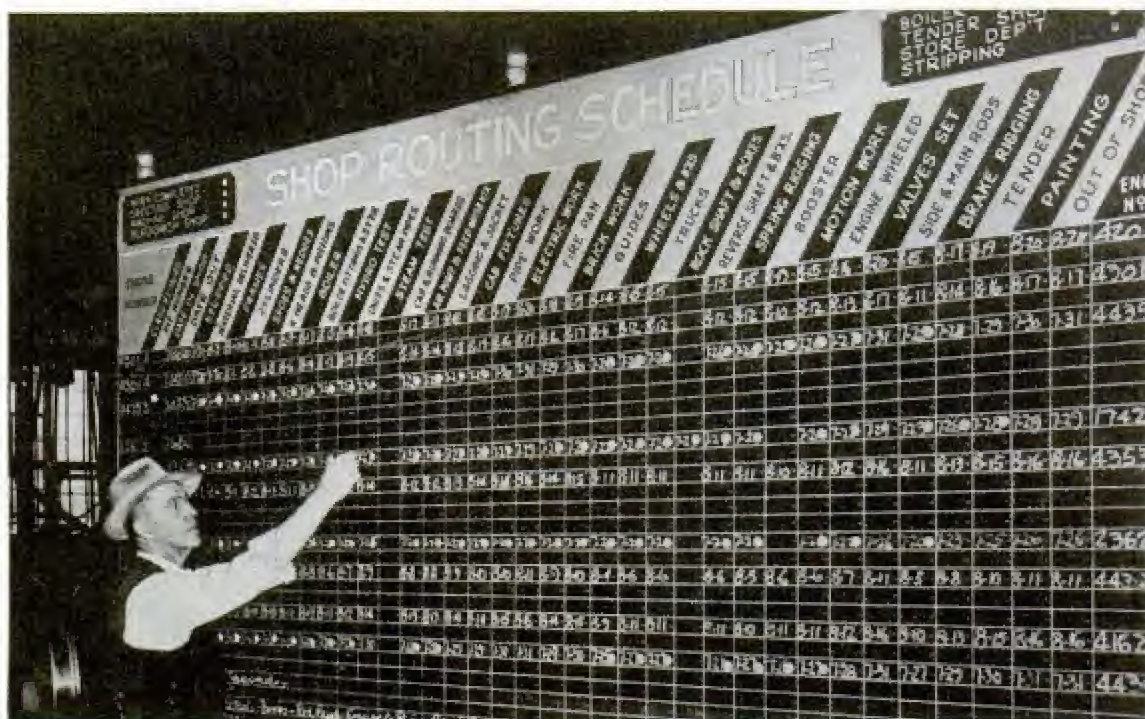
attention every 160,000 miles, depending on conditions. Formerly these locomotives were sidetracked to wait their turn in the shops, but not now. Each is taken out of service in time to coincide with the shop schedule. Each locomotive steams directly from its job to the shop space assigned to it, where the maintenance crew is already waiting. This careful scheduling increases by a number of days per year the amount of active service that each locomotive can deliver.

In the shop, too, new and improved methods help get the power units back on the rails with less delay than in the past. When a locomotive's tires and flanges wear unevenly from tough service it is no longer necessary to remove the

wheels and turn the tires on a lathe. Instead, the cutting and smoothing tools are attached to the engine in place of its brake shoes and the engine is then hauled back and forth along a stretch of track alongside the shop. Tires are brought to proper contour in 24 hours on this Lidgerwood device as compared to the additional days formerly required.

A railroad engine literally never wears out. It is built to give 50 years of service but reconstruction begins long before that age. Driving axles, crank pins, tires and wheels, are replaced periodically. Boilers are rebuilt. At the end of 20 years an en-

Schedule board in railroad repair shop that helps speed up reconditioning of iron horses of the rails



gine has few if any of its original parts.

Obsolescence instead of old age retires a locomotive from the main lines. New and more powerful models force their retirement to unimportant branch lines where they in turn replace still smaller engines that then go out of use. War reversed this procedure. Every old engine that could be brought back into service is chuffing along today. Some old timers that were built at the beginning of the century and that recently had served as stationary steam plants are back on the branch lines. Southern Pacific alone resurrected more than 100 of these old "tea-kettles," converting some of them from coal to oil burners and equipping those that needed it with improvements and safety devices that have come into use since their prime.

Thousands of women are employed today by the S.P. to replace in part the more than 12,500 men who have joined the Army. Women are doing such jobs as painting cars, tossing rivets, oiling the engines, working in the foundries. They are performing in 39 different occupations. Mexican laborers have been imported to work on the track, and in areas near their reservations, Indians are similarly employed. S.P. has also appealed to able bodied civilians of all kinds to spend their holidays working to keep the roadbeds in shape for today's record traffic. The result is that on any week end you can see gangs of grocers, teachers, salesmen, municipal employees, and high school students dressed in old clothes and working on the right-of-ways as their part of the campaign to "Keep 'Em Rolling."

DECEMBER, 1943

International Harvester Co.
180 N. Michigan Ave. Chicago, Ill. 570
Self-Propelled Farm Combine
Cuts Without Harming Grain



With cutter in front, self-propelled combine is single, integrated machine

Contrasted with the conventional combine, which is pulled by a tractor, a new self-propelled combine is a single, integrated machine powered by its own motor. Its cutter and grain platform are immediately in front of the operator, permitting him a constant view of its operation. With the self-propelled machine, also, operators may go into a field of grain and cut the first time around, without knocking down any grain. It is also possible to use it in fields of wheat or other grain that have ripened unevenly—a common condition—for with it the farmer may cut the field selectively, destroying neither ripened nor unripened grain.

71587
Worn Grinding Disks Are Renewed
With Cement and Abrasive

Eight flexible grinding disks do the work of 200 fresh disks with the use of a renewing kit consisting of a cement and abrasive. When the grinding face is worn or paint-loaded, it is merely soaked in water for one hour, after which the abrasive surface readily wipes off, leaving the surface of the disk clean. To apply new abrasive, new cement is brushed on, the abrasive is shaken on—much as one uses a salt cellar—and the abrasive is embedded firmly by rolling with a glass roller. The cement can also be used to make cloth adhere to cloth, cloth to metal, or paper to metal.



Left, applying cement; center, shaking on abrasive; right, embedding it

National Abrasives Co.
4650 Chene St.
Detroit, Michigan

Mr. Stimson

71423

PUTTING *the* FIGHT in FIGHTER PILOTS

By
Thomas E. Stimson, Jr.



Top, loading belts of ammunition into ammunition trays in the nose of a P-38 Lockheed Lightning. Below, test-firing a Lightning's four nose guns



DO YOU think that friend of yours who joined the Air Forces a year ago to become a fighter pilot is ready to knock down Japs and Germans by now? Not by a long shot. True, he's been to primary and basic schools, flown a fighter at advanced school, and has served with an operational training unit.

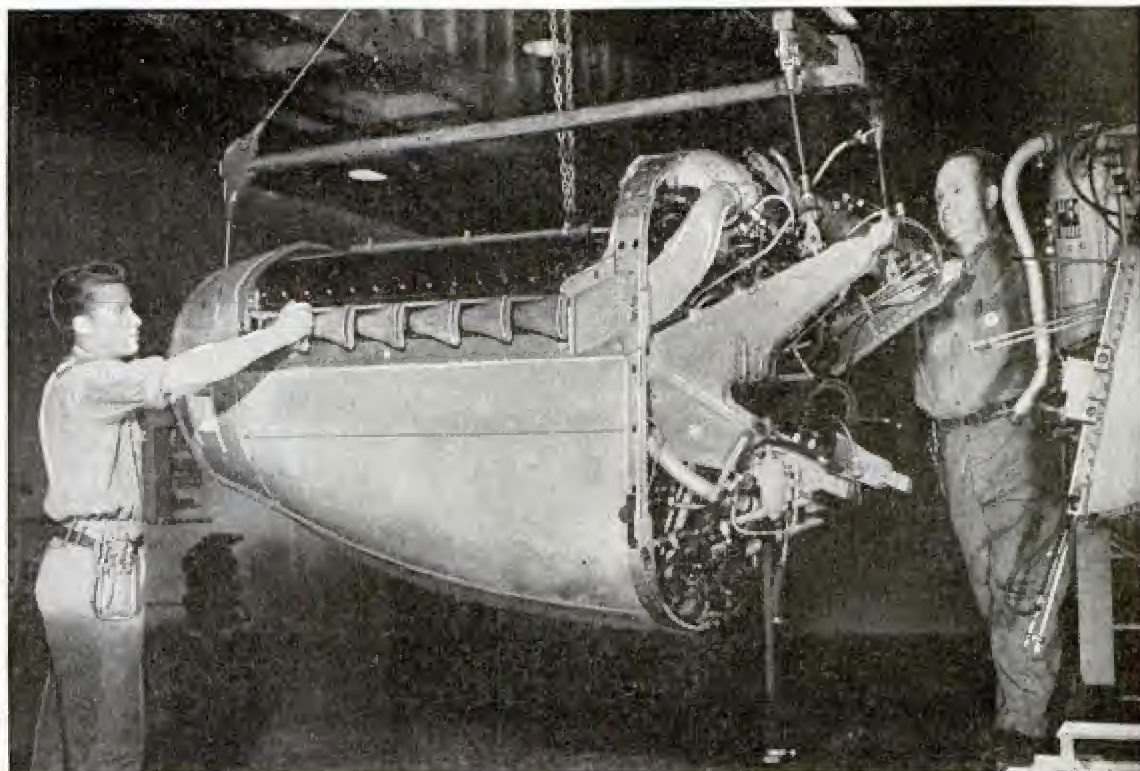
Already he has been flying the type of fighter plane he will use in action. He knows how to service and flight-check it, he knows its hydraulic and electric systems by heart, and he even spent 10 hours blindfolded in the cockpit reaching out and memorizing the positions of every control knob, wheel, lever, and switch. He can retract the wheels, trim the tabs, snap on his electric gun sight, and punch the correct radio pushbutton automatically, in his sleep. But he is not yet ready for combat duty.

He looked pretty good on his last day at the training unit when he and his squadron leader climbed into fighting planes and went aloft for an aerial duel that was something like a final examination.

They leveled off at 20,000 feet a couple of miles apart and came straight at each other, throttles all the way forward. They were only a couple of hundred feet apart when they passed at a relative speed of 800 miles per hour and the act of passing was the signal that the duel was on.

Each man yanked his ship into a climbing turn and immediately blacked out from the strain. A bitter dog fight started, each pilot trying to get on the tail of the other. Each was "out" almost half the time from the violence of the maneuvers.

Public Relations, War Dept.
Washington, D.C.



Installing the engine unit, complete with its cowling, in the fuselage of a P-51 Mustang fighter plane

The planes were so high that from the ground you could hardly see them but you knew from the muffled moans and groans of the exhausts that the battle was on. It was no longer student and instructor, it was man to man. It was as deadly a duel as either would ever fight against an enemy except that camera guns were used instead of bullets.

Possibly your friend passed that exam as well as any one could. Maybe the film in his camera showed as many hits as did the instructor's. But he was still a trainee pilot when he landed. It costs up to \$500 per hour to keep a fighter plane in the air and the Air Forces want only experienced pilots. For his final coaching he is assigned to a domestic fighter squadron.

Here he learns the reasons for some of the maneuvers he rehearsed so often in the lower schools. Flying a tight formation seemed fun in school even if it was difficult to stay not much more than 100 feet from a companion plane while turning, diving, and climbing in unison. He

understands now that such a tight formation can save his life and that it is the fighter pilot who wanders off by himself who is apt to be shot down. Holding formation with another ship provides twice the fire power of a single plane, and allows you to guard your companion's blind spots while he guards yours.

While with the squadron the trainee pilot learns there's one way to fight Germans,



A trainee pilot pulls down cockpit hatch of a P-38 before taking off



Squinting into the square of glass set at an angle, the P-38 pilot sights his weapons by reflection of his electric gunsight

another to beat Japs. On the whole, American planes are faster, so the trainee is taught to take advantage of his superior speed when tackling a Nip. He makes a pass at the Jap, breaks away to regain altitude, then makes another pass if the Jap wasn't knocked out the first time. He uses different tactics when fighting a German. German planes are about as fast as ours but not as maneuverable.

By now, too, the trainee begins to pick up some of the tricks of his trade. He

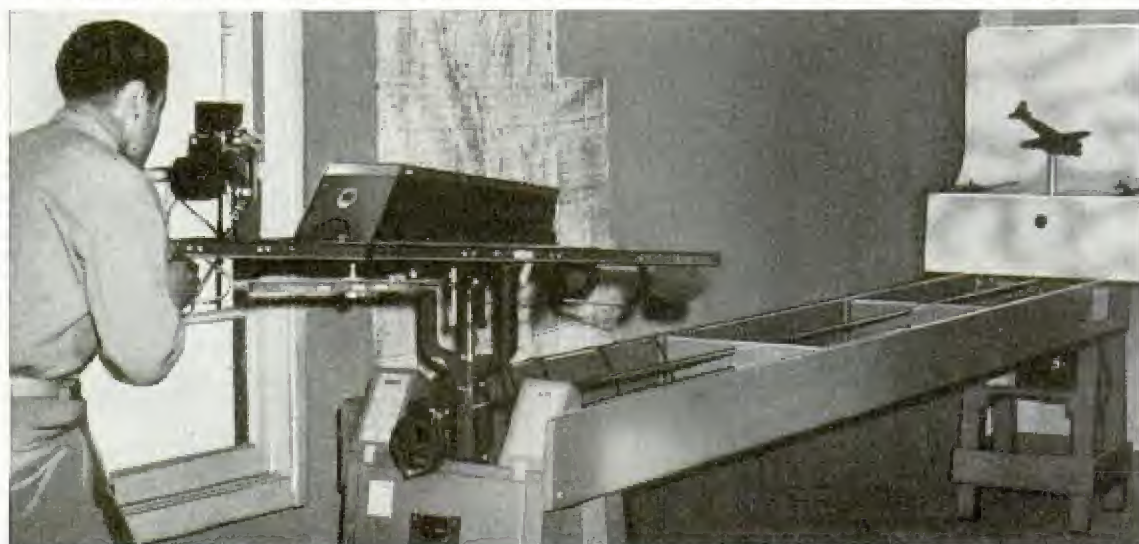
learns, for instance, that in a tight spot it is possible for him to maneuver so wildly the enemy pilot on his tail will black out in trying to keep up. That gives him a chance to grab the advantage.

He learns the weak areas in the cones of defensive fire from enemy bombers and the angles at which he should attack them. He is taught to dive vertically right in front of an oncoming enemy bomber, firing into the bomber's path. He acquires the knack of leading a target by just the right amount to hit it. He learns to fire his guns trustingly at empty air, knowing that the fast-moving enemy will fly right into the path of the bullets.

In fact, gunnery now becomes his obsession. He practices at skeet to get the feel of holding a lead on targets, and he does a lot of practice on a complicated target machine that works on the same principle as the slot-machine-gun games at amusement centers. This machine has a gun sight, a trigger that operates a light beam, and a background that contains a small

target airplane equipped with a photo-electric light cell. Hit the airplane with the light beam and the photo cell records the hits, adding up the score on an illuminated board. From his position behind the gun sight the student pilot can turn wheels that change the attitude of the target plane, and he can move a control that gives the stationary target any theoretical speed from 200 to 400 miles per hour. The amount the pilot must lead the target in shooting at it depends on this theoretical speed.

A fighter pilot in training uses a mechanical target machine, sighting at airplane target in background





This Lightning interceptor carries auxiliary fuel tanks which it will drop before going into combat

Practicing with this machine isn't anything like the thrill of firing real bullets at a sleeve target towed by another airplane. The sleeve target is small and hard to hit but the trainee pilot feels sure he will tear it apart every time he throws his combat switch and presses the firing button. The recoil of his machine guns makes his plane vibrate as if he were driving over a cobblestone road at high speed.

He spends 100 hours in the air while with the fighter squadron, rehearsing dog fighting and formation flying. The way his airplane handles depends on the altitude so when he becomes proficient at 10,000 feet he moves up another mile and starts in again. The higher he goes the more carefully he must make the turns to avoid a spin that would reduce his altitude and put him at a disadvantage.

But now he is accustomed to the routine of one hour per day of physical exercise that all pilots regardless of rank must do. Every morning, too, he gathers with the rest of the pilots while the intelligence officer gives them a resume of events in the theaters of war, new tricks of the enemy, and the latest dope on enemy aircraft.

He takes a few days off from ordinary flying to attend altitude school. Here he makes his flights in a pressure chamber instead of a plane. He sits down in the chamber without his oxygen mask and observes, as the pressure is reduced to simulate high altitude,

that his fingernails turn blue and that in his mind he is as competent and confident as ever. That's the joker in altitude flying. Confidence, overconfidence, and unconsciousness follow in rapid succession. The point is driven home that he must always use his oxygen mask in altitude operations and that he must make sure, by glancing now and then at the flapper valve in the cockpit's oxygen line, that oxygen is continuing to flow to his mask.

Finally this postgraduate instruction comes to an end. Possibly our pilot will move with his squadron into active service. Possibly he will be assigned as a replacement to a squadron already abroad. It seems like a long time since he won his wings; now, finally, he is fit for combat.



Fighter pilots study silhouettes and shapes of American and enemy tanks for instant recognition at 400 miles an hour

Working Model of German Tank Acts in Movie



In producing training motion pictures, the Signal Corps makes constant use of miniatures, because of their low cost, and their adaptability. Realistic battle settings, from the sandy wastes of the desert to the glacial peaks of the Arctic, may readily be constructed, and as rapidly torn down. On the screen in final form these sets, and the miniature war materiel moving across them, are realistic and convincing. At left is shown model of a German M-IV tank, slated to be "blown up" during a sequence of the film, in a reproduction of battle scene in North Africa

Signal Corps photos

Right, care of detail in reproducing the Nazi tank is shown in the independent action of vehicle's bogie wheels, and in picture below, showing that hatch door on turret actually opens. Note detail of tread construction



Photo at right shows how tank and its setting are mounted on a platform for the shooting of a scene. To reproduce, full scale, such a realistic locale, and to use full-size motor equipment would mean the expenditure of time, money and skill that can better be employed elsewhere—say in building real tanks for real foe



*Know Metal Mfg. Co.
Canton, Ohio.*

Drop-Bottom Dump Box Carried by Lift Truck

N 585

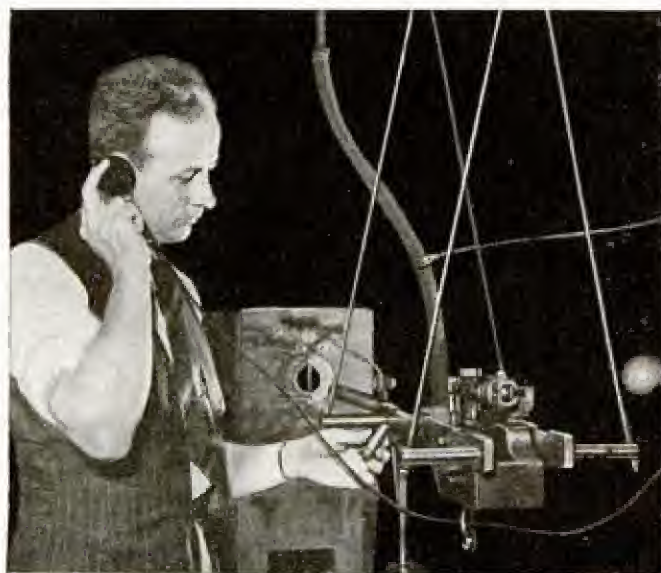
Spot dumping of materials is achieved with a drop-bottom dump skid box, an all-steel box attached to a skid platform with a continuous hinge at one end. For spot dumping of materials, side plates form a chute to prevent spilling of the contents. When these side plates are extended to the box top, with a crane loop welded to each plate, the unit may be transported by crane. The unit may also be used as a standard skid box for unit load transportation, or handled by hand lift trucks for short operational spotting.

Spot dumping of materials is accomplished with drop bottom dump skid box, mounted upon a power truck. Side plates form chute to prevent spilling of contents when the unit is used



Wire-Held Pendulum Gun Gives Shells a Five-Way Test

N 549



In the proving house of the Winchester Repeating Arms Company is a "quintuple-threat" device for testing shot shells. Called a "pendulum gun," because of its suspension by four wires, the testing device simultaneously reports five things about any shell tested. Fired only once, it measures the relative recoil, velocity and pattern of the shot, breech pressure, and barrel time. Before its advent, several different guns had to be used to make the same tests.

*Ballistics Laboratory
New Haven, Conn.*

Gun suspended by wires is used to test shot shells, reporting on five aspects of the firing test, and replacing many guns

Navy Makes "Fish Talk" Recording to Help Train Submarine Crews

N 642

Men who operate the sensitive listening devices on submarines are trained to distinguish between the sounds made by the hum of enemy propellers and fish noises. This is done with a special recording of "fish talk" made by the Navy and the Wildlife Service of the Department of the Interior. Grunts, purrs, drumming noises and other sounds like grinding of teeth

were recorded in the service's seacoast laboratory at Beaufort, N. C. The noisiest of all is the bad-tempered toadfish who makes a sound that compares with a steamboat whistle. The croaker makes a drumming sound that can be heard through 20 feet of water by vibrating a handlike muscle against his air bladder. The black drum feeds noisily on oyster shells.



SCHOOL for SEA CAPTAINS

Above, cadets study the deck gun on a merchant ship
Gunnery training with a 20-mm. anti-aircraft weapon

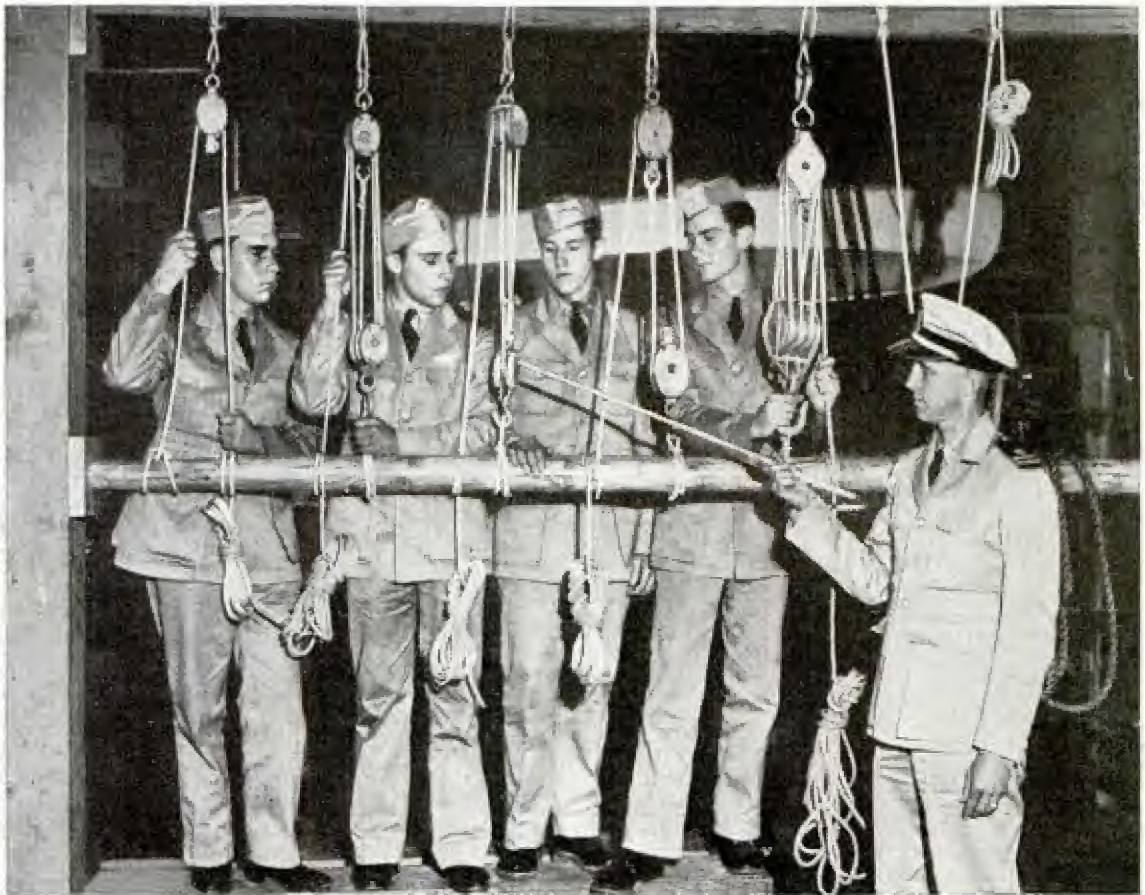


AMERICA'S future sea captains and chief engineers are attending school today. As cadet-midshipmen of the United States Merchant Marine they study on shore, go to sea for six months, then return for eight months of final instructions before they begin their careers as ship's officers.

In spite of their status as students, some of the cadets already have distinguished themselves. These days merchant seamen often have to fight in self defense. One cadet recently sank an enemy torpedo boat that was raking the bridge of his ship with machine gun fire. Two others have received medals for bravery in manning a deck gun and sinking one of a pair of raiders attacking them.

On the walls of the clubroom of the cadet basic school at San Mateo, Calif., names already have been enrolled on plaques dedicated to cadets who are "missing in action" and to those who are "survivors of enemy action." Men who survive a torpedoing automatically become members of the Torpedo Club, similar to the Caterpillar Club of aviation.

The greatest merchant fleet in American history is at sea today and more ships are being launched. One of the purposes of the cadet corps is to provide competent officers for these vessels. Promotions can come rapidly and it is possible for a cadet to get



his captain's papers, ranking him as master of ocean-going vessels, within three and a half years from the time he joins the service. In peacetime, of course, promotions are much slower.

You don't become a Merchant Marine cadet-midshipman simply because the idea appeals to you. Even if you qualify for training you can still be dropped if you fail to keep up your studies. But if you are from 18 to 23 years of age, unmarried, have a minimum of 12 high school credits, and can pass the naval reserve physical examination, you stand a good chance.

First, however, you will be enrolled in an apprentice seamen training school such as the one at Avalon on Catalina Island. Here young men are trained as ordinary seamen or as firemen for service at sea. At the end of 60 days, if you have displayed the qualities that America needs in its merchant marine officers, you may be recommended for cadet training.

Those chosen as cadets take an intensive 10-week course of study at San Mateo, at Pass Christian,

Various types of blocks and tackle are demonstrated at the "school for sea captains." Below, sighting with an instrument used to measure distances at sea, vital in lining up convoy





Future merchant marine officers study a huge Diesel engine crankshaft

Miss., or at King's Point, N. Y. A new cadet draws \$130 worth of uniforms and \$38 worth of books during his first day at school. If he completes the training the equipment becomes his. During his training period, too, he will be paid \$65 per month in addition to receiving meals and quarters, plus bonuses while at sea. A cadet may select training as either a deck officer or an engineer officer.

His school day starts early and ends late and he does most of his studying under the guidance of the one instructor in charge of his section. The faculties are composed of naval reserve officers, instructors chosen by the War Shipping Administration, with a few officers who have seen recent action in the Navy.

This preliminary 10-week course is in the nature of a survey of what the cadets will learn in more detail later on. Those who chose the deck department are taught ship construction, cargo handling, navigation, and seamanship. Those who take the engineers' course study ship construction, electricity, steam engineering, and Diesel engines. Deck cadets are taught to use semaphore flags, international code flags, and radio. Engineer students learn the use of common hand tools and learn to repair machinery. In the machine shop they even build cold chisels from raw bars of metal, make their own depth gauges, and use hand tools to create hex nuts from round bars.

Naturally, gunnery is an additional subject. The cadets learn to operate and service machine guns and automatic cannon, and they practice on a loading machine that simulates a large deck gun. Meanwhile they have been studying practical seamanship. They sail small boats, learn to launch

lifeboats from four common types of davits, how to go over the side in an emergency, and how to use lifesaving gear. Before they graduate from basic training they make an overnight trip in a crowded lifeboat to be prepared for such an experience at sea.

The school life is a full one yet the cadets get a few leaves for recreation. Their gymnasium is equipped along nautical lines. A "name" orchestra plays during meal-times and they have a dance once a month. They make trips to inspect ships in port and are taken on tours of shipyards and marine engine works.

Those whose grades put them in the bottom 20 percent of their class flunk out. The balance go to sea for their six-month cruise. It's no vacation, for in addition to performing the work assigned to them they must continue their studies. They serve with the ship's officers and in some instances cadets have taken over the duties of junior officers. Two deck and two engineer cadets are assigned to each Liberty ship, more cadets being assigned to vessels of larger size. During their sea time, cadets are exposed to all the hazards of sea-going life, for their ships go to all parts of the world, around it, and right into the combat zones. Casualties among seamen during this war have amounted to three percent of their number, triple the percentage sustained by the armed forces.

Going to sea gives you an understanding of the importance of the subjects you studied at basic school. You come to understand that a modern ship is a complex machine and that technical training and competence are required in its officers.

After their half year at sea the cadets are assigned to the United States Merchant Marine Academy at King's Point, Long Island, N. Y. Here they take up again the same subjects touched on in basic school, this time studying them in more complete detail. They take practical cruises in sailing yachts and Diesel boats operated by the Academy. This "college" course lasts eight months, in which time the cadets cover ground that ordinarily requires four years to complete. At graduation they take examinations for appointment as third officer or third assistant engineer. Then they are ready to begin sea careers, drawing salaries of \$200 to \$300 per month to start.

By the end of this year our merchant marine will consist of more than 3,000 ocean-going vessels and will require the services of more than 30,000 licensed officers. The United States expects to maintain its present standing in international trade after the war instead of allowing its shipping to dwindle as at the end of the last war. That means that those who seriously take up the profession of ship's officer will find room to rise to the top.

Ship's officers are also trained at the officer schools of the U. S. Maritime Service at New London, Conn., and at Nep-
tune Beach, Calif. These schools give a four-month course for men who have served at least 14 months at sea, and who are up to 50 years of age. The course leads to examinations for third officer or third engineer. Men are paid \$126 per month, as well as meals and quarters, while at school.

If you would like to learn more about entering the cadet corps, write the Supervisor, Merchant Marine Cadet Corps, Division of Training, War Shipping Administration, Washington, D. C.

"The profession of ship's officer," declares Rear Admiral Emory S. Land, chairman of the Maritime Commission, "calls for red blooded men who will not flinch at danger—who will not shirk when the work is heavy—who will not quit when the going gets tough. Above all, it calls for young Americans with a desire for a life at sea."

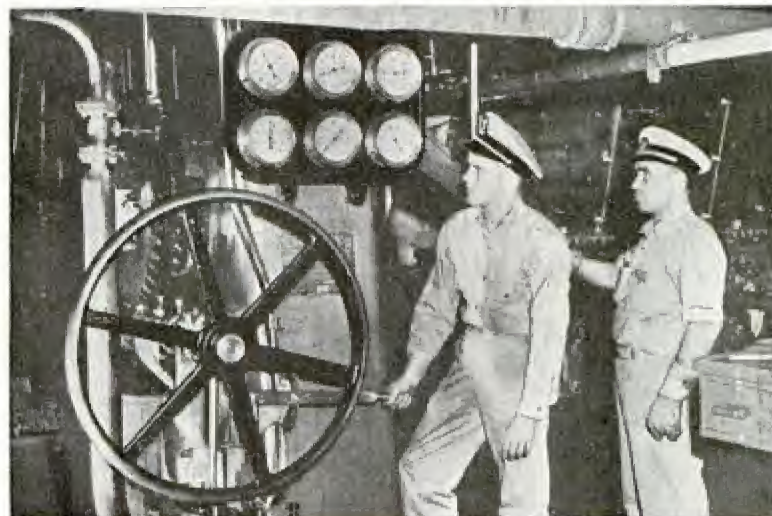
"To young men who can qualify, the training received as cadets, prepares them for an officer billet on vessels which carry the flag and commerce of this nation to every port on the seven seas."



Cadets above are learning to load belts of .50-caliber bullets into an anti-aircraft machine gun. They must be able to handle the gun blindfolded



Studying a light machine gun, above; submarines crash-dive in a half minute, dive-bombers offer a target only a few seconds and the navy gunner must be quick on trigger. Below, getting acquainted with engine room



U.S. Navy

7495

Gasoline Drums Are Seabees' Building Blocks



Classic examples of American ingenuity at work are found in the way the Seabees, the Navy's Construction Battalions, use empty gasoline drums as building materials. Either intact or flattened, the drums are prized for construction. Left, shoring up a dock with some flattened drums



Especially in the tropics, where almost daily downpours endanger machinery, a roof is essential—so a Seabee crew makes one, with a "Spanish tile" effect, out of sections of the drums. Roof is being laid over an open-air machine shop

U. S. Navy photos



With their tops and bottoms removed, the gasoline drums make ideal storm sewers. Above, men are laying such a sewer, fitting the drums together, end to end. At the right is the "before and after" effect of flattening the empty drums. In background are the empty drums, ready to be fed to the mechanical roller. In the right foreground, the end product—piled-up metal sheets



Mortar Without Base Is Aimed by Knotted Cord

As an improvement on the Jap "knee mortar," or grenade thrower, Yanks in the field have discovered that the American 60-millimeter mortar, used without either base plate or bipod, can be aimed and fired by one man. The mortarman uses only the tube itself which together with 10 shells, weighs only 42 pounds. The mortarman sits facing his target and pounds the spherical projection of the mortar into the ground to seat it. His legs are extended with feet well apart, heels dug in, and knees turned in to hold the mortar tube. His head is kept well back from the muzzle blast. He holds the tube well down from the muzzle to permit the tube to slide through as it sinks during firing. Having prepared the charges on the number of rounds he wishes to use, he jerks the safety pin from the round and drops it down the tube in the customary way. To help judge elevation, according to a correspondent of the Infan-

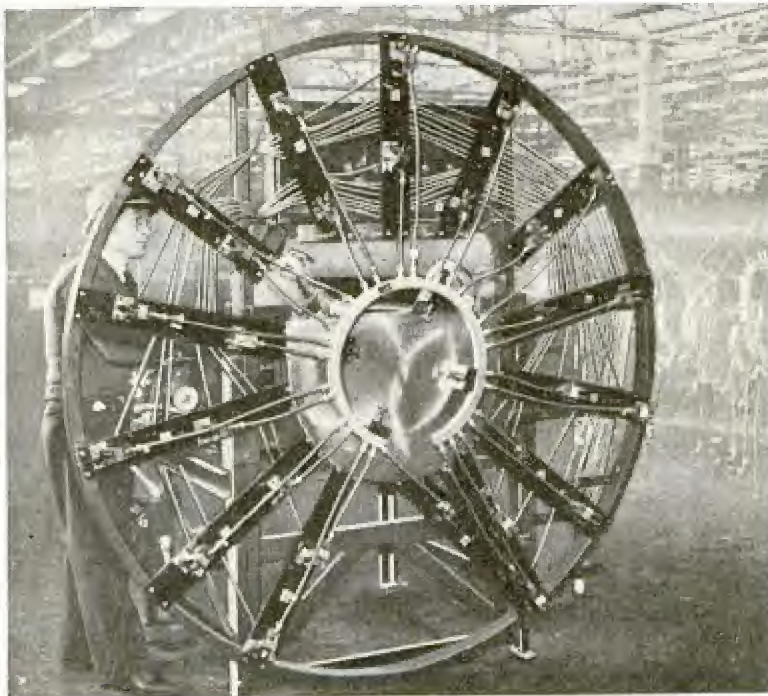


Minus heavy base plate and bipod, U. S. 60-mm. mortar can be carried by one man (inset). Knots in cord represent predetermined firing elevation

try Journal, a string tied near the muzzle is allowed to fall vertically to the ground. Knots are tied at intervals in the ground end of the cord. Raising or lowering the muzzle also raises or lowers the cord, so that the knot representing any predetermined elevation just touches the ground.

71534

Giant Wheel Tests Ignition for Plane Before Installation



Ignition wiring on Pratt and Whitney aircraft engines is given a thorough test on a huge wheel which reveals broken wires or incorrect timing. This saves valuable time by checking the ignition systems before they are installed in the bomber engines. The test wheel, developed by Buick engineers, closely simulates the actual position of wiring on the plane. Plugs leading to the wires are mounted on a panel facing the inspector, who can quickly detect those that are not firing.

Ignition wiring on the wheel is connected with plugs on a panel before the inspector

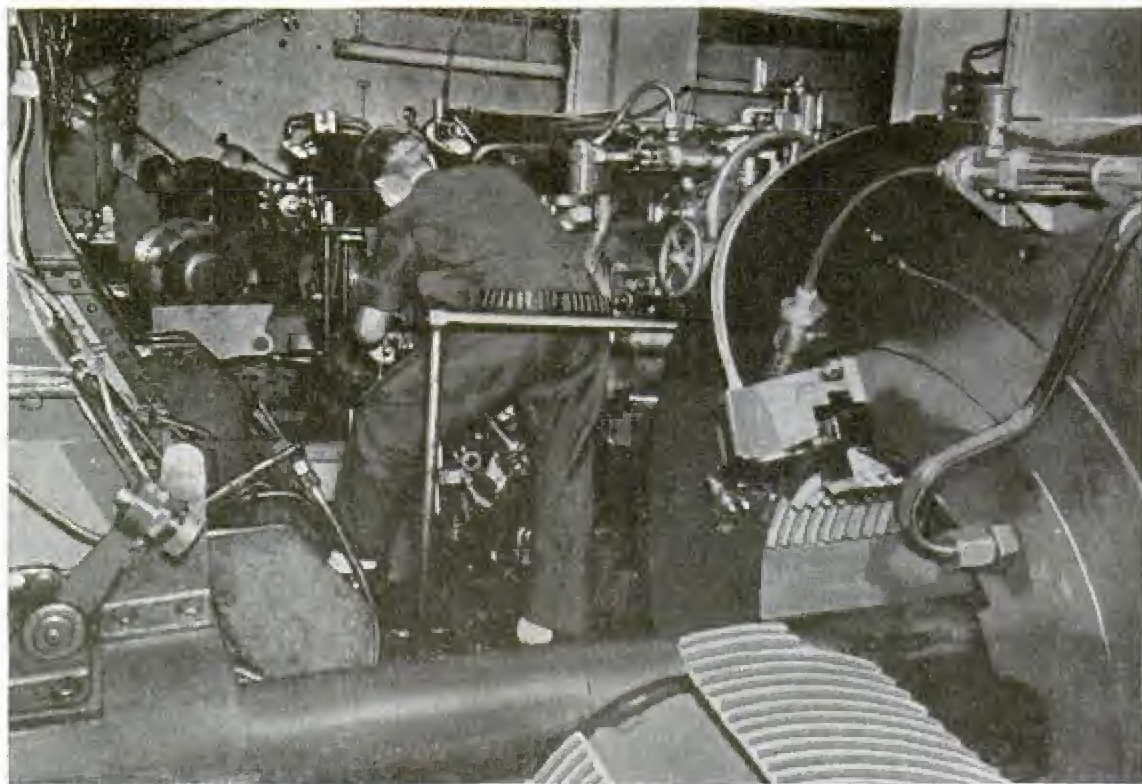
Reprinted from: Regus 436 v 437, The Illustrated London News
April 17, 1943

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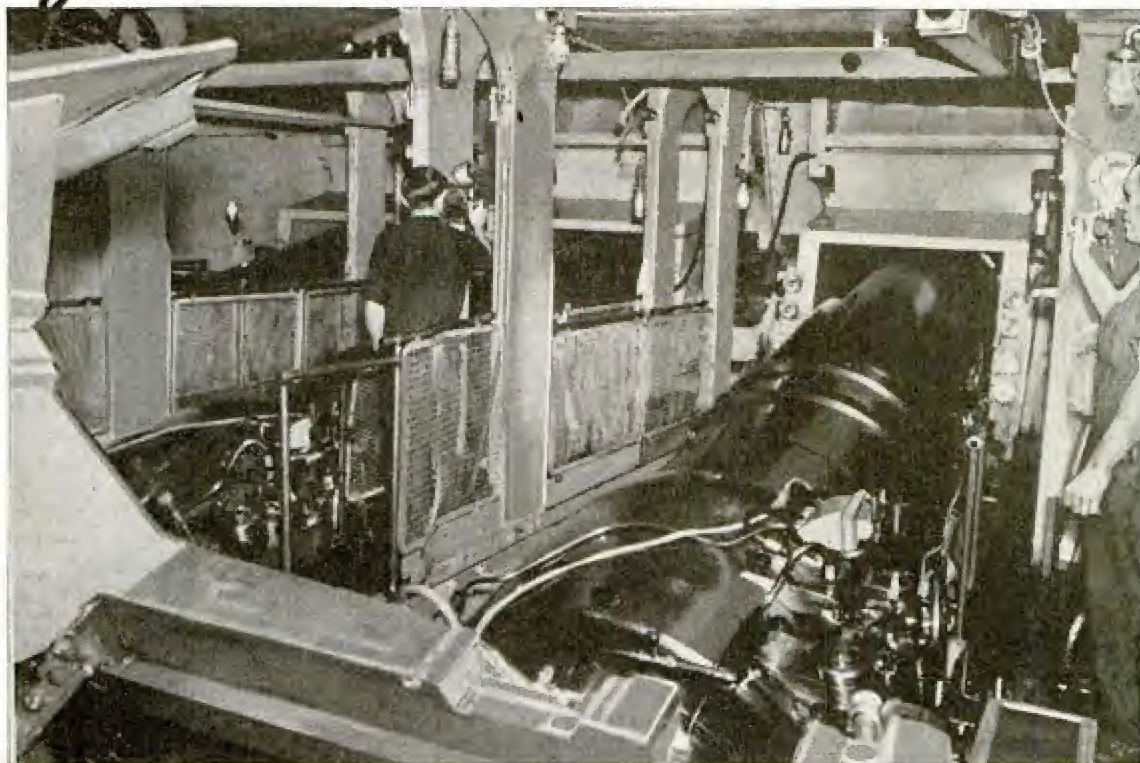
INSIDE *the* TURRET



Mightiest weapons of the United Nations battle fleets are the 16-inch guns of the American and British battleships. These pictures were taken inside the turret of a British man-of-war. Above, gun layers follow the movement of elevation pointers on the dials before them. Pointers are operated from the fire-control room. Layers raise the barrels to angle needed to fire shells proper distance. Below, guns in loading position



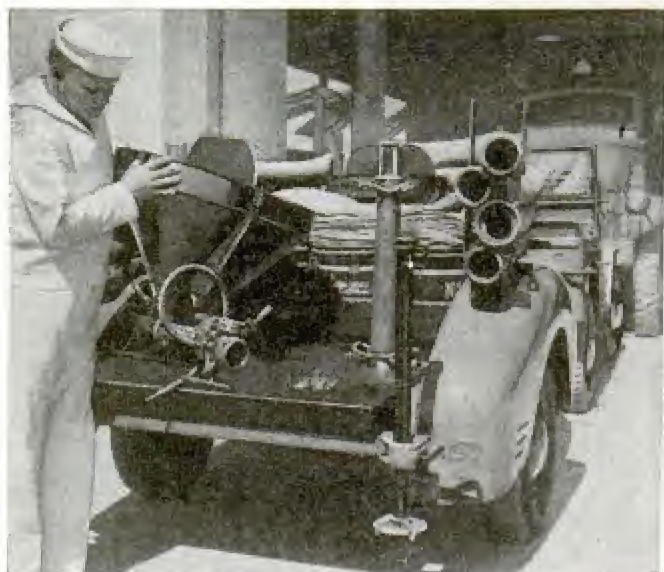
of a 16-INCH GUN ☆ ☆ ☆



Inside the gun-house of the main turret on a battlewagon, the guns (above) are loaded and trained on the target, the order "broadside" has been received. Men wait for the sound of the fire gong, their signal to turn the firing switch that sends the shells on their way. Below, in the rear of the gun-house, gun captains transmit orders through speaking tube to gun layers. Sailor, right, uses eyepiece of a big range finder



Developed by *Harold Johnson M M 2c U.S. Navy 71508* Navy Fire Trailer Mounts Portable Foam Unit



Blankets of foam to smother fires at a Navy advanced base emanate from portable units that may be unscrewed from a jeep-hauled fire-fighting trailer. With the two units attached to the rear of the auxiliary car, the entire vehicle may be rushed to the scene of a blaze, where the foam units may be removed and carried directly to where the fire is gaining headway. Direction of the wind becomes less a factor to the fire-fighters, because the unit may be moved about at will.

Jeep-drawn fire-fighting trailer has a portable foam unit, which may be taken off for use at the exact spot where the flames are beginning to make headway

Pilots Get Blindfold Training in Location of Instruments *71571*

Though there are almost 100 devices in his bomber's cockpit, a student pilot must be able to locate all of them by the sense of touch alone. His hands are given a sort of tactile education when he is seated, blindfolded, at his station and ordered by an instructor to reach for and grasp any instrument or device—or any combination of them. When reaching for such controls becomes second nature, he will be saved the future risk of diverting his attention from enemy sky while on an operational flight in a war zone.



Blindfolded student pilot must "think with his hands" to locate instruments

Supersensitive "Electric Ear" Detects New Sounds in the Human Body *71612*

R.C.O. Buy 71.4. 71.4. 71.4.
Sounds of the human body never before heard by doctors are picked up by a sensitive acoustic stethoscope developed in RCA laboratories. When placed over the heart, lungs, stomach, or other vital organs, the improved stethoscope relays a new range of murmurs, squeaks and rattles. The full range of body sounds, from 40 to 4,000 cycles, is covered by the new instrument, compared with the ordinary stethoscope's limited range of 200 to 1,500 cycles. The advantage of the acoustic stethoscope, according to Dr. Harry F. Olson, who developed it, is due to a reversed taper tube that amplifies the sounds and widens the range.

Detection of weak sounds is also made easier because the stethoscope is insensitive to air-borne noises. Because so many new sounds are heard with the instrument, a filter was built in to limit the range by turning a knob. This is believed to be the first major improvement on the stethoscope which was invented in the early part of the nineteenth century by a French physician.

¶ You can obtain additional information about products described in this magazine by writing to the firms listed in the Where-to-Buy-It index on page 4A. Say You Saw It in Popular Mechanics.

Photostat 4, N.Y.

71 527

Revolving Penthouse Prop "Freezes" Shadows

On the roof of an Eastman Kodak Company building is what appears to be a misplaced cottage, mounted on wheels. The multi-purpose facade is at once a photographer's prop, a darkroom, and a film tester. Of particular value in taking a series of pictures, the penthouse half revolves, to enable the photographer to work all day with the same shadows from the sun. The interior, not needed for picture settings, has been made into a darkroom. A camera platform attached to the house by a catwalk revolves with the cottage, keeping the camera always in the same position in relation to the scene being "shot."



Inside the revolving penthouse that follows the sun is a handy darkroom

Film in production is constantly tested by actual use, as well as by chemical checks, so the penthouse is designed in a variety of colors and materials to test the film's reproductive qualities. The roof is of red

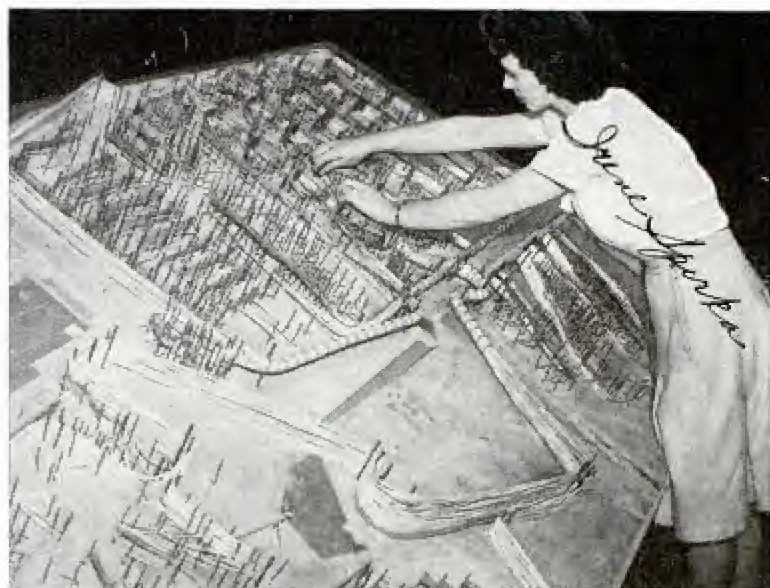
asphalt shingles; sidewalls of yellow stucco; door and trim of weather-beaten wood, steps of Pennsylvania blue stone, eaves and drainpipes of brown, and a small patch of concrete walk completes the color scheme.

71 536

Wire Wound on Peg-Top Panel Controls Gun Electrically

Professional puzzle-solving is the daily routine of women workers at a Western Electric Company plant, who assemble the wires that help to give American guns electric control. Their task is to thread a series of wires, forming a cable in the computer

unit of the gun director, around and through pegs protruding from a tilted panel. The pegs are so spaced that completion of the task keeps the circuits of the computer unit in proper order, though at a glance the workers seem to be busy at a more-than-usually intricate parlor game.



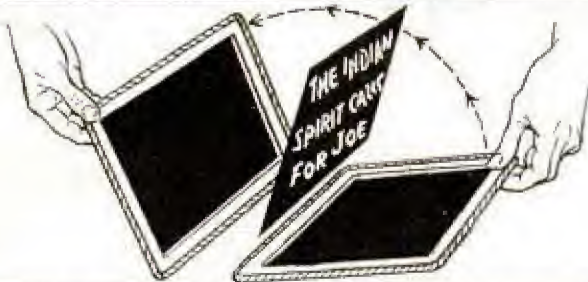
Maze puzzle is really the cable in the computer unit of a gun director

Shades for Flares Shield the Eyes Of Bombardier

Flares dropped from bombers are equipped with shades of woven glass fibers to protect the eyes of the crew and keep the plane in shadow. The bombardier would not be able to see the ground in the dazzling light of a magnesium parachute flare of about one million candlepower. The shades, made of "glass cloth" with a dark finish, are light in weight and withstand the heat of the flares.



Mind "THE ~~HAND~~ IS QUICKER THAN THE EYE"



% Wisconsin Tourist Bureau, Chicago, Ill.
By Joseph Mercedes

Veteran of 35 years on the stage, currently touring military camps with a U. S. O. troupe

209 W. Michigan
ANYONE can learn sleight-of-hand. In 15 minutes I can show you how to perform tricks with which professional magicians could mystify audiences indefinitely. You might practice these stunts until you were letter-perfect—and you still wouldn't be a magician.

For, to paraphrase an old line, the mind, not the hand, is quicker than the eye. Consciously or not, good performers always use what I call "mental magic" in putting across their acts. They sell their stunts, sell the audience on something that isn't true. They peddle deception.

To do this they develop a patter, a line, "showmanship," call it what you will. Being what the theater knows as a mentalist, an exponent of telepathy, I like the term "mental magic."

For an illustration, last spring I made an expose of the ancient spirit-slate trick before an audience of friends. This calls for a special "prop"—a double slate, which has an extra slate panel that fits into one of the halves to conceal a "spirit message" which the performer writes in advance.

The occasion was the climax of the North African campaign, so to apply mental magic, the secret message I wrote was: "Tunis and Bizerte will both fall within 48 hours."

When my friends were assembled I instructed them:

"Think of the most important thing to America today." With the radio and newspapers full of the African war, I knew they would think of that. They did. And when

Double "spirit slate" has an extra panel, flopped over when slate is closed to reveal "ghost message" written in advance



Above, noose around actor's neck is really two separate ropes. Diagrams are at right

I disclosed the "spirit message," they were half inclined to believe something supernatural had occurred—until I disclosed the phony slate panel and told them the message had been written before the "seance" began.

In the handkerchief trick illustrated here, mental magic also plays a big part. If you work that stunt before your entire audience you can do it only once. To do it properly, send several people out of the room and call in one person at a time, pull the stunt on that one individual, then seat him where he can watch the next's befuddlement.

Your victim is provided with a hat out of which you will eventually pull the handkerchief. Stand close to him, and roll the handkerchief up in a tight ball in front of his very eyes—the closer the better. When it is tightly wadded, throw it up and over his head with your right hand, at the same time bringing your left hand sharply down below the opposite arm. He'll watch your left hand, and presume you've hidden the handkerchief under your arm.

Use your showmanship here. When he guesses where you've concealed it, pretend he's solved the trick. Ask him, in mock disappointment, "Haven't you seen this done before?" He'll proudly say no, that he's just super-observant. Then show him he guessed wrong, and watch his face fall.



Before rope is pulled, fingers and thumbs are inserted under ropes. Yanked noose seems to slice through the actor's neck





With your left hand, grasp his right arm, saying:

"Turn around here so the audience can all see this."

At the same time, open your left hand to receive the handkerchief from your assistant, who, lounging inconspicuously behind your victim, has caught the handkerchief behind his back and now hands it to you, also behind his back. Take off the victim's hat with your right hand, drop in the handkerchief above his head, lower the hat to where he can see it, and draw out the handkerchief.

This trick is so simple as to seem almost childish. Rest assured that if you do it properly, your victim will never see that handkerchief sail away.

In the first rope trick, your victim ties your wrists together with a handkerchief. Bend your wrists slightly apart when he ties it, to leave a little play for your hands. He next loops a rope around the inside of the handkerchief and holds the two ends of the rope. It doesn't appear you can possibly get free.

Here, too, showmanship is called for. Prove you're caught. Struggle against the rope, twist your body to show that whichever way you turn the rope loop merely slides up your arm and still holds you tight. Now you are prepared for the astonisher.

With a sudden motion, draw back until the rope is tight, then lunge toward the person holding the rope. Make faces; pretend you are in some sort of agony; your audience will watch your face instead of the solution of the trick, your hands.

When you step back you draw

Handkerchief sails over dupe's head; aid catches it. Dupe guesses it's under performer's arm. It's "recovered" from hat



the rope down tight, to where you can palm it—catch the looped end with the heels of your hands through the encircling handkerchief.

As you lunge forward, you acquire sufficient slack in the rope to free yourself merely by tucking the fingers of one hand beneath the loop in your palms, and sliding the loop over the outside of the hand. The entire rope comes free—and there you are, wrists still tied!

The other rope trick demands a little advance preparation. Take two similar lengths of rope, and loop each until the four free ends match in length. Then take the two loops of rope thus formed and slip one loop through the other. Secure this loose connection beneath your shirt or coat collar. You'll have to hold your neck fairly rigid to keep it there.

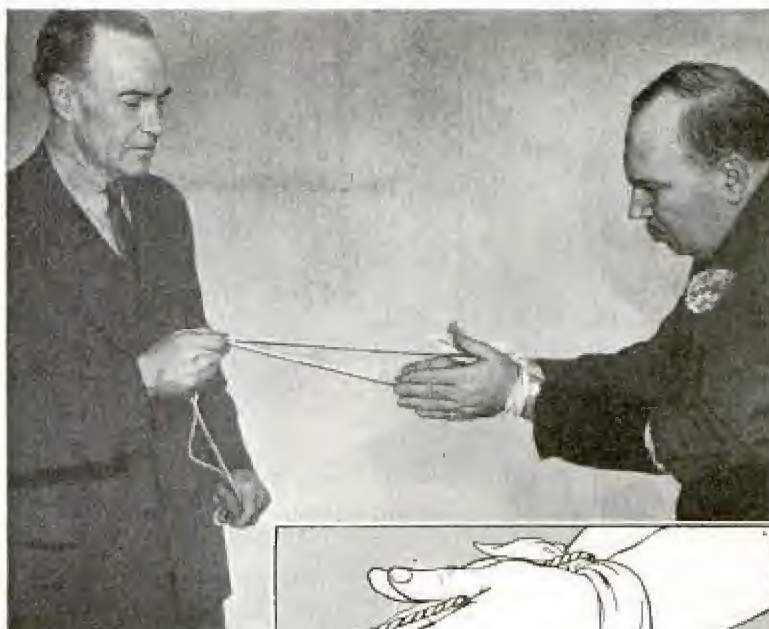
Now you're ready to face your audience. You appear to have two separate ropes passing around your neck, with four ends dangling. Have someone tie the four ends over your throat, in a variety of hangman's knot, if you will. He can knot it as often as he pleases.

When this is done, hold your hands over the knots as though they were too tight, and you are trying to get some slack. What you are actually doing is inserting a thumb and finger from each hand under one of the ropes on each side of your throat.

Tell your victim:

"At the count of three, pull hard. One, two, three!"

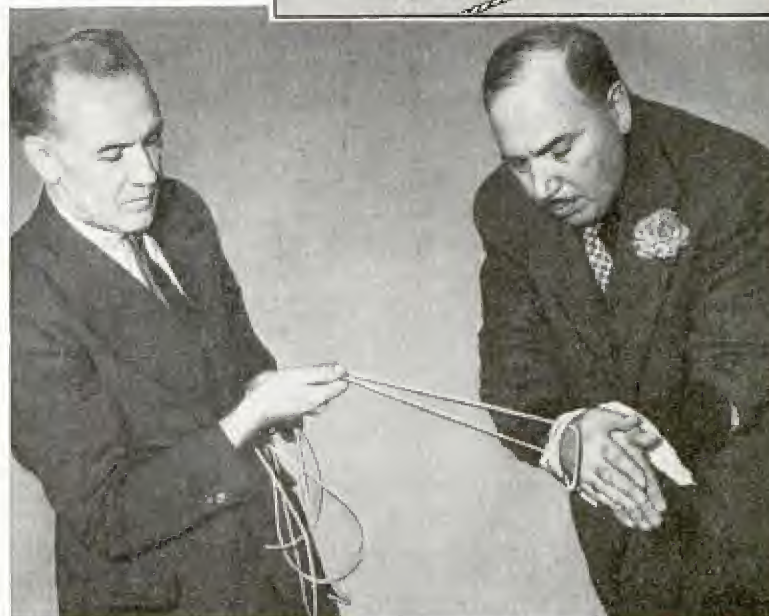
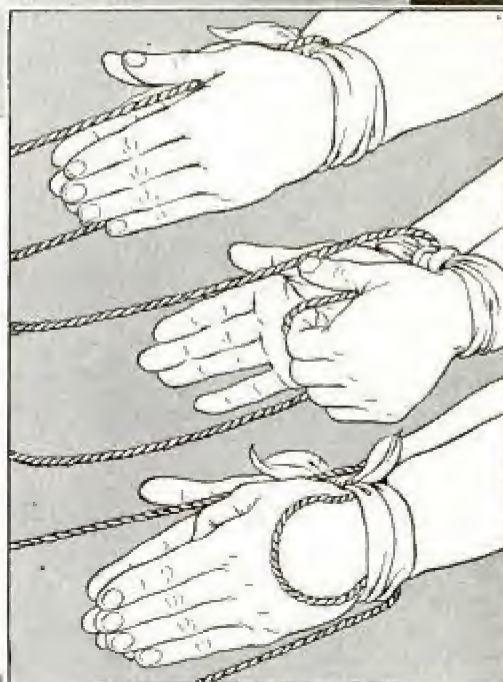
At "three" he pulls, and the rope—which isn't tied in back at all—comes away. But your thumbs and fingers under the separate strands hold the freed ends in an unbroken



Wrists tied with handkerchief, performer appears held by a loop of rope in hands of dupe. But he'll soon be free

Sketches, right, show steps in freeing himself. Top, he draws back and "palms" rope with heels of hands. Center, fingers slip under the loop thus formed. Bottom, a twist—rope is free, wrists still tied

Picture below shows how rope slips away. Naturally, action is too fast for dupe to follow; actor will see to that





Rubbing palm on trousers (inset) will generate static electricity that will make pen or pencils adhere

noose. The effect is that the whole noose has simply come right through your neck, leaving you mysteriously unhurt.

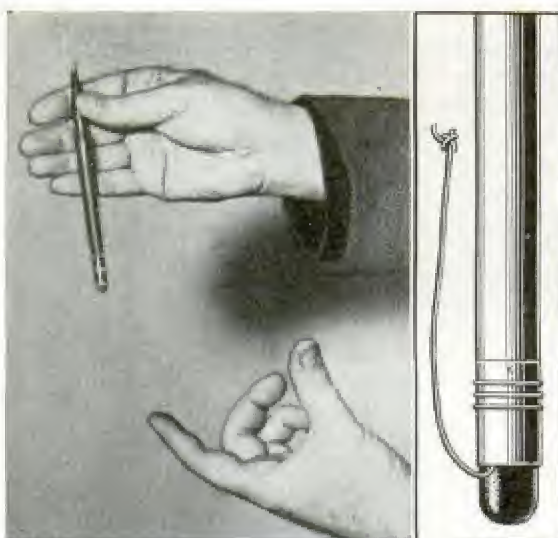
Two pencil tricks are next. In the first you can pretend to have discovered a new and powerful source of "body magnetism." Take an ordinary pencil, remove its eraser, insert one end of a rubber band, and replace the eraser. To do the trick, you have the rubber band running up the back of the pencil, where the audience can't see it, and you hold the free end between two fingers.

Make mystic passes over and under the pencil with your other hand, and it springs up! The tension of the rubber band, of course, makes it jump. Save this for last, when you have your audience convinced you're a mystifier, and chances are they won't even suspect you're using a prop.

If they do suspect, let them inspect the pencil—after you have secretly withdrawn the rubber band.

The other pencil trick isn't really a trick at all. It makes use of the fact that rubbing your palm against your clothing—hard, until the palm fairly burns—will generate enough static electricity to hold the weight of a pen or pencil at almost a 90-degree angle to the floor. With enough practice you can hold several pencils; try it at first with one, and with your palm at a less severe angle.

While the pencil or pen is adhering to your palm, you can make it roll over and back again by slightly tipping your palm from side to side. Your audience won't even notice that your hand moves, yet the pencil flops over, as though by occult force. When the pencil begins to slide off, tell it to fall, and it will appear that you controlled even that action. Don't slight this



Tucked under eraser, rubber band's other end is held between fingers. Loosen thumb grip, pencil leaps up

stunt; it really is simple and effective.

Figure out your own deceptive variations on all these tricks. In the last trick, the "adhesive pencil," let the victim suspect you do have glue on your pencil, then prove you haven't by borrowing his and performing the same trick with it.

In the handkerchief trick, lead him to ask if you didn't have a second handkerchief concealed in the hat all the time, and prove you didn't by repeating the stunt with any other hat he suggests.

Magic acts are among the most popular nowadays with service men. There is scarcely a U. S. O. unit extant that doesn't include a magician. Now, I'm not disclosing any of those professionals' secrets. As a veteran of so many years on the stage myself, I have too much respect for fellow performers to do that; I know the tedious hours they have spent in perfecting the mechanics of their acts.

Besides, even if you were a combination of Thurston, Blackstone and Houdini, knowing all the stunts that made these men famous, you would not rank as even a good amateur unless you were equally skilled in the art of mass deception.

You might use atmosphere—a phony costume and jungle jargon—with the "spirit slate," for instance. That is one way unscrupulous persons have long used this trick to pretend to the credulous that they actually do receive messages from the "great beyond."

In the handkerchief trick, work up your own variations. Your subject might, for instance, ask to see the trick performed a second time. Pretend that you're disclosing it. Tell him you actually did conceal the handkerchief beneath your coat, and show him in slow motion how you "blinded

his eyes" with one hand while concealing the handkerchief in your coat with the other.

"You can see it when I do it slowly," you tell him. "Now watch, and see if you can still follow it when I do it fast."

Then perform the complete trick again, skimming the handkerchief over his head. Chances are 90 to 10 he'll say,

"Oh, I saw it go under your coat that time."

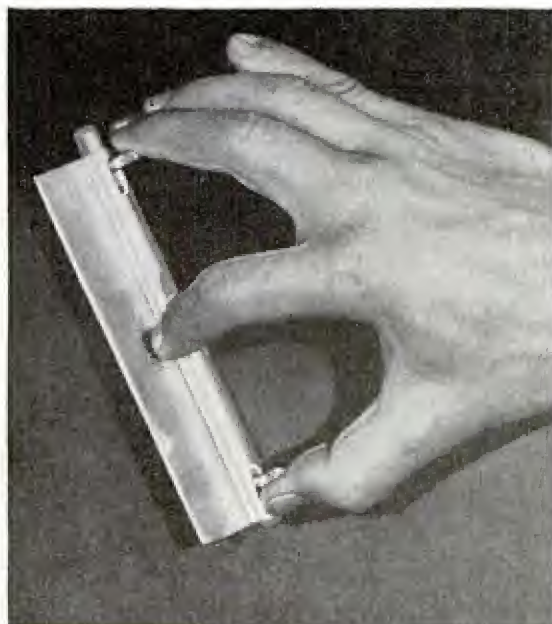
Now when you show him it wasn't there, he'll be properly amazed, and your audience will eat it up—those who are in the know.

It's the proper choice of patter that makes your subject believe you're doing something you're not.

Remember, it's "mental magic," the art of mass deception, that marks the good performer.

Hinge Held by Spring Tension Removed by Simple Squeeze

Originally designed for ordnance use but now available for other applications, a hinge held in place by internal spring tension can be removed by pressure of the fingers. Retaining pins of the hinge are held in a protruding position until the releasing pins are pressed. The hinges are designed for use where it is necessary to remove them frequently for cleaning. The new unit can be used on machine tools, generator housings, automotive equipment, household doors, shelves and tables, and on marine hatch covers, cowlings, and on folding seats and tables, such as those used on airplanes.



When cleaning is necessary, a squeeze removes hinge

DECEMBER, 1943

Bucklyn Co.

3429 Glendale Blvd., Los Angeles, Calif.

One Man Carries Casualty With 'Humpbacked' Litter



Wounded man is held by straps on pick-a-back litter

Weight may be supported more readily by the back than by the muscles of the arms, which is one reason for the development of a new method of carrying wounded men from the battlefield. A pick-a-back litter supports the wounded man on the back and shoulders of the hospital corpsman, while straps keep the victim's body in place. One man can take the place of two stretcher bearers, virtually doubling the effectiveness of the medical crew.

Tires Wear Four Times Longer At 35 Miles Per Hour

At 65 miles per hour, tires wear out four times as fast as they would at a speed of 35 miles an hour, according to a study of 2,000,000 miles of tire travel conducted by the Engineering Experiment Station of Iowa State College, and the Public Roads Administration. Tire mileage at 65 miles per hour was estimated at 18,700 miles. The test, which was conducted on all major types of roads, also showed that recapped treads made of 95 percent reclaimed rubber are good for 14,000 miles if speed is restricted to 35 miles an hour. Other measures that added thousands of miles of wear to tires studied in the survey were periodic inspection, slow starting and stopping, reduced speed on sharp curves and steep hills, and a weekly inflation checkup.

Office of War Information
Federal Works Agency
Washington, D.C.
87

7/ 533

"Rumble Seat" on Crossbar Gives Passenger Safe Ride



On crossbar seat, inset, tiny passenger rides safely

When Dad or Older Brother wishes to give Junior or Sister a bike ride, the problem usually is: Where to put the passenger in safety? Frames over the rear wheel may be dangerous, and seating the passenger on the handlebars is both uncomfortable to the rider and cumbersome. A comfortable and convenient bicycle "rumble seat" may be made by mounting an extra bicycle seat on the bar midway between the regular seat and the forks. A wooden crossbar fastened to the forks, or to the post, provides a convenient footrest.

Enemy Patents Offered by U. S. To American Factories

Approximately 45,000 patents and patent applications formerly enemy-owned or controlled have been offered as a wartime "windfall" to American industry by the U. S. Alien Property Custodian. For the nominal fee of \$15 any manufacturer can obtain a license, on a non-exclusive basis, to produce these inventions during the war and postwar periods. The patents and applications range over the whole field of mechanical, chemical and electrical arts. In one recent week 27 of the 599 new patents granted had been applied for by enemy inventors. Since the war began, all enemy-controlled patents have been vested in the Alien Property Custodian, with headquar-

ters in the Field Building, Chicago. One of the latest German inventions was an unusual internal-combustion engine of radial type with two pistons in each cylinder. At the same time a formula for ersatz sausage casings was patented by another German. Among other patents and applications filed by enemies and now available for American exploitation are an Italian jet-propulsion airplane; an altimeter using a projected radio beam directed at the ground and reflected back to a receiver in the opposite wing; an electromagnetic train for carrying mail and parcels, as between an airport and post office; an ammunition loading system for warplanes; extension pedals to permit two riders to use the same pedals on a bicycle; and a tandem cargo plane system by which a high-powered tow plane with light load, towing a heavily laden freight plane to which it is coupled by a ball-and-socket joint, assists the heavier craft into the air. An index of these patents is available for a small fee on inquiry to the Alien Property Custodian.

"Bird" Landing Gear for Plane Made With Leaf Spring

Leaf landing gear for training planes, that saves many hours of production time, has been approved by the Army Air Forces Materiel Center at Wright Field. Its function is similar to that of a bird's legs. The leaf spring gear is made from flat, non-critical steel plate stock cut to shape and bent to form. Despite the lack of recoil snubbers used in conventional gear, the new type strut does not cause the plane to bounce when it hits the ground. The spring gear spreads out upon contact with the runway and the sideways motion of the tires upon the ground absorbs the recoil.



Strut spreads out to cushion the shock of landing

POPULAR MECHANICS
Leaf Spring Installation
316 Woodward Bldg.
Detroit, Mich.

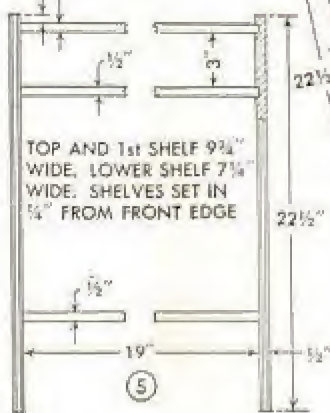
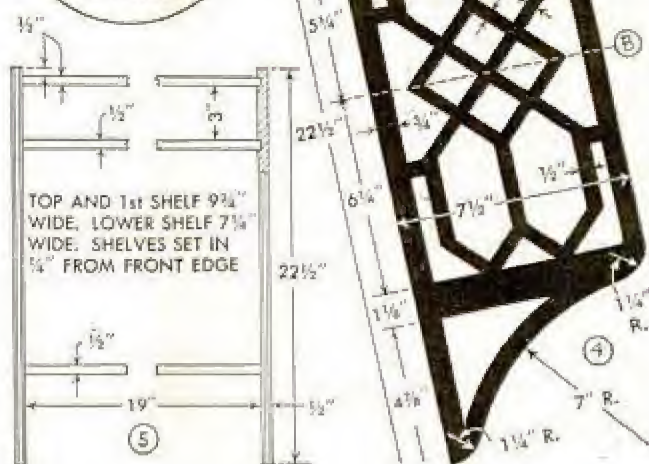
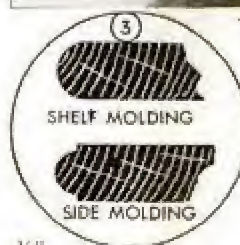
Mr. 7 Lloyd M. Craske
4424 - 440 5th St. San Diego, Calif.
Alien Property Custodian
Washington, D. C.

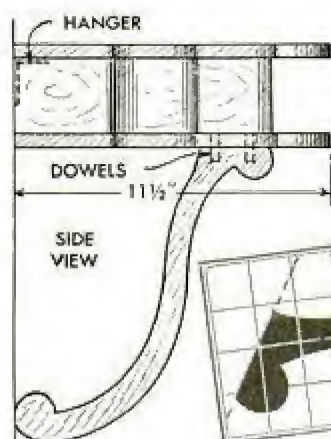


Two Smart TELEPHONE SHELVES

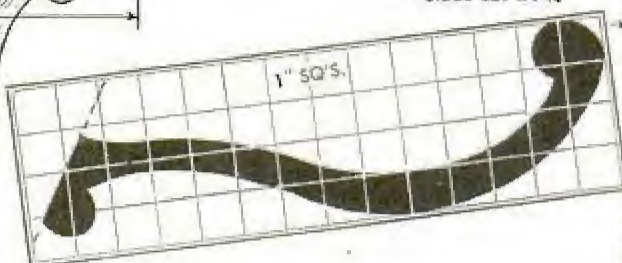
by Charles E. Truett

NO FLOOR space is taken by either of these neat little telephone shelves, as they hang right on the wall where they are out of the way when dusting around the baseboard. Both have built-in space for a directory besides a pad and pencil. To make the one shown in Fig. 2, first lay out a cardboard pattern of the fretwork sides according to Fig. 4. Dotted lines A, B and C represent centerlines of the cutout portions, lines C being located with a 45-degree triangle from line A. After the pattern is cut out, a wooden template is cut to match the outside contour of the pattern, which is used as a master pattern in shaping the edges with a molding like the one shown in Fig. 3. As any irregularity in the template will be duplicated in the work, the edge of the template should be smoothed carefully and coated with wax or



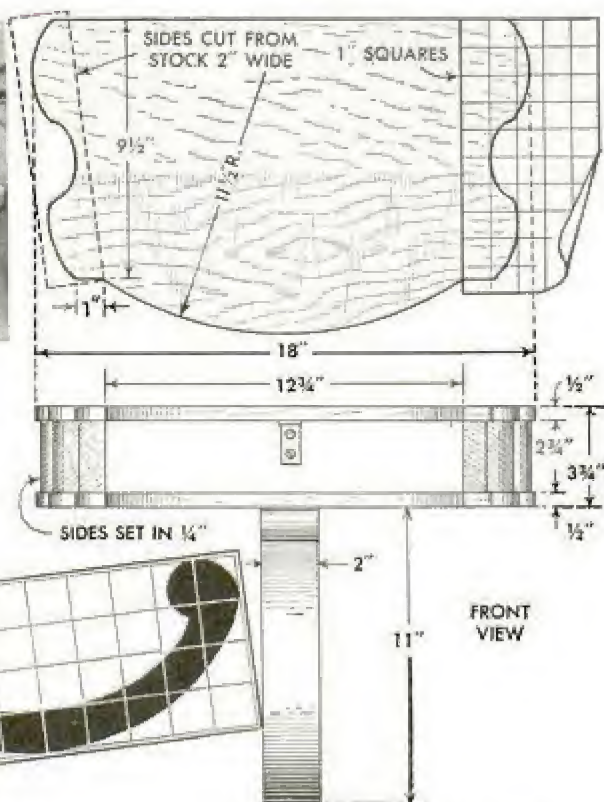


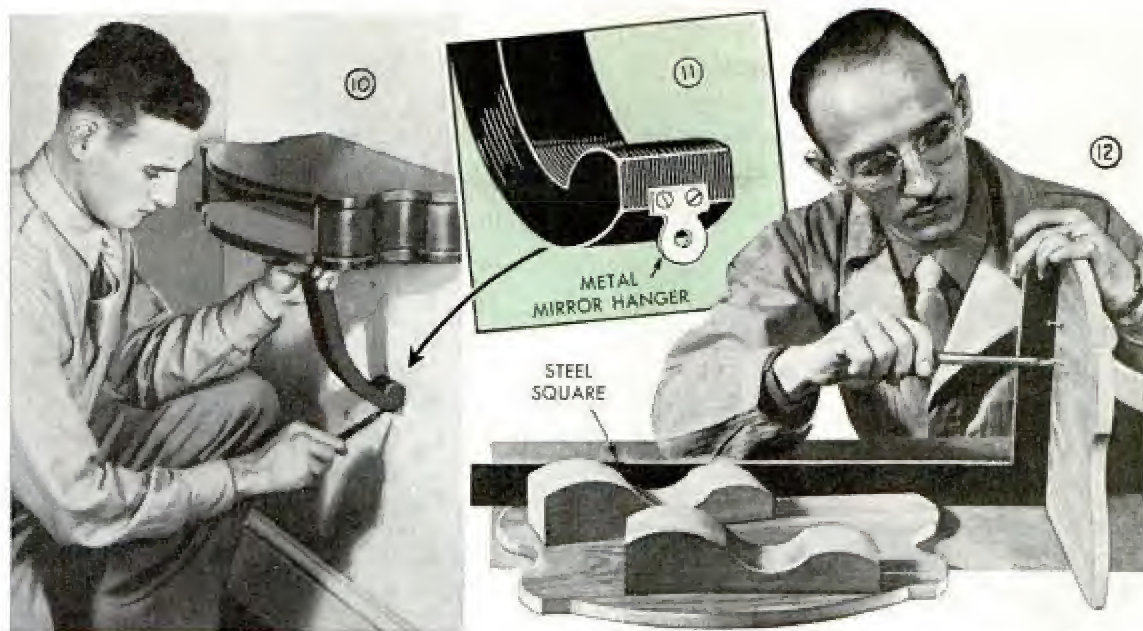
9



paraffin to reduce friction against the spinning shaper collar. The $\frac{1}{2}$ -in. stock for the sides should be about $\frac{1}{8}$ in. wider than the width of the template, and is fastened temporarily to the latter, flush with the rear edge, by a couple of screws driven into the waste parts of the fretwork. After this, the work is bandsawed as in Fig. 6, sawing around the template about $\frac{1}{8}$ in. away from the edge. With the work attached to the template, the edges are shaped as in Fig. 7, the template being on top and a starting pin engaged in the table. The shaper collar used should be of a size that will keep the work about the same size as the template. You may find it necessary to allow more than a $\frac{1}{8}$ -in. margin around the work, depending on the size collar and cutter at hand. The best procedure to follow in running the mold is to start at the rear and go across the end grain at the top and down the front edge. This will give a clean cut as you will be going with the grain most of the way. Keep the work moving and apply just enough pressure to hold the work in contact with the collar, to prevent burning the wood. Each side piece is shaped in this way. If a number of pieces are to be cut from the same template, it is best to make it of hardwood, so that repeated usage will not wear the working edge too rapidly and thus change the original shape of the template.

Now with the work removed from the template, the blind grooves for the three





shelves are cut with a dado saw or router, spacing them according to Fig. 5. These should be cut about $\frac{1}{4}$ in. deep and stop $\frac{3}{8}$ in. or so from the front edge. Next, the fretwork design is traced on the work as in Fig. 8, after which it is scrollsawed and sanded. If your saw can handle 1-in. stock, time can be saved by tacking both pieces together and sawing at one time. In fitting the shelves to the sides, note that they must be notched at the corners to set $\frac{1}{4}$ in. from the front edge. Angle brackets for attaching the shelf to the wall are screwed to the underside of the top before assembling with a resin-type glue. Finally, the work is checked for squareness before drawing the clamps up tightly.

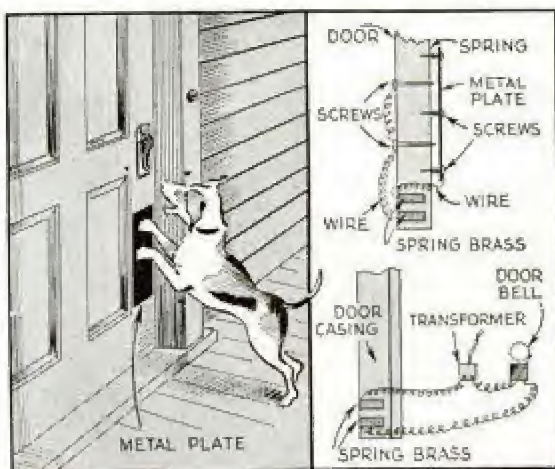
Both top and bottom shelves of the model shown in Fig. 1 and detailed in Fig. 9, are bandsawed from panels of solid stock glued up of several pieces. The pattern used in

marking the ends of the shelves also can be used to mark the thick end blocks to which they are glued. This merely requires drawing a second line $\frac{1}{4}$ in. in from the first, which represents the amount the ends are set in. If solid stock is not available, built-up blocks of $\frac{3}{4}$ -in. stock, glued face to face, will do for the end pieces as well as the brace. The bottom shelf can be attached to the end pieces with f.h. screws, as they will not show, but the top will have to be fastened with several blind dowels. If screws are used to attach the brace from the inside, it will have to be done, of course, before gluing the top in place. A framing square, used as shown in Fig. 12, will assure the brace being at right angles to the wall. An angle bracket is provided to fasten the shelf to the wall at the top, while a mirror hanger is screwed to the end of the brace to hold it at the bottom, Figs. 10, 11.

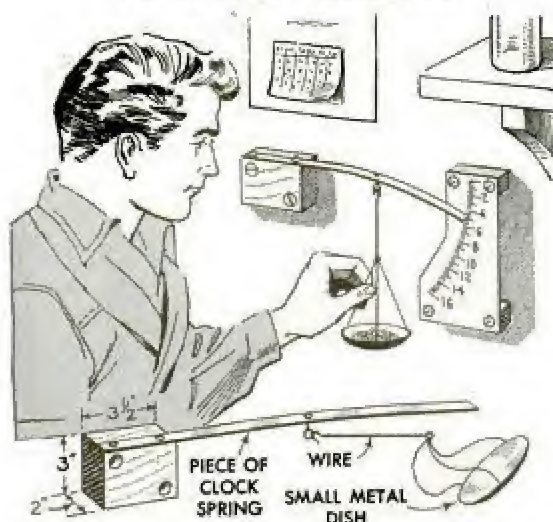
Dog Rings Doorbell When It Desires to Enter the House

Instead of barking when it desired to enter the house, our dog scratched the door, which not only marred the wood, but often we did not hear the dog. To avoid this trouble, I made the switch shown, mounted it on the door and connected it into the doorbell circuit. As shown, the switch consists of a metal plate held by screws over which springs are slipped to hold the plate about $\frac{1}{16}$ in. from two contact screws. These screws are wired into the bell circuit, the wires running to two spring-brass strips on the hinged edge of the door where they contact two similar brass strips on the casing. Wires from the latter strips run directly to the bell circuit.

—A. E. Rehnberg, St. Paul, Minn.



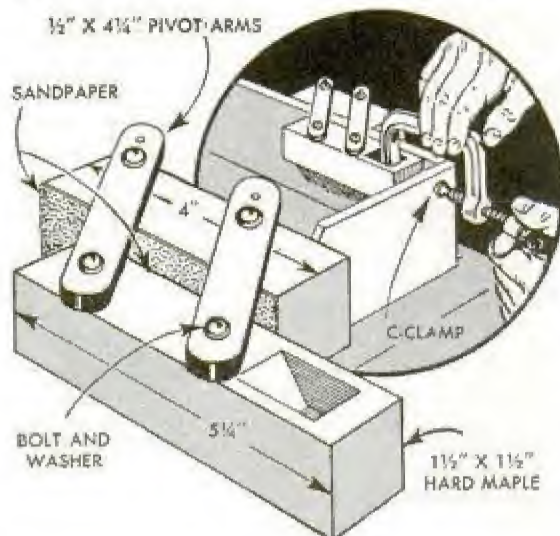
Simple Scale From Clock Spring To Weigh Chemicals



Made from a piece of clock spring and a couple of wooden blocks screwed to a wall, this scale is used by one experimenter for weighing chemicals in his laboratory. Also, it is handy for weighing chemicals in a photographic darkroom. The scale consists of a length of clock spring, which is screwed to a block so that the free end reaches to the center of another block or a piece of paper near the first one. A small tray is suspended from the spring as indicated. The block or paper is calibrated by weighing objects of known weights and marking the positions of the spring end on the block or paper.

Substitutes for Bar Clamps

If you do not have a long bar clamp, here is a good substitute that will enable you to use a C-clamp for the same purpose. Two wood blocks are pivoted together in a parallel position with a couple of pieces



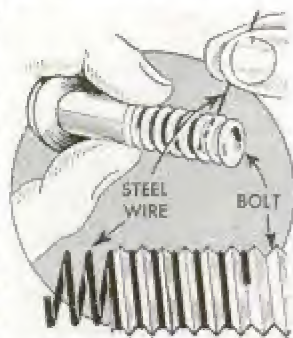
of flat iron as shown, the inner surfaces of the blocks being covered with sandpaper to improve their grip. In use, the block assembly is placed over the work, after which one end of a C-clamp is placed in a pocket cut in one of the blocks, thus permitting two pieces of work to be pulled together regardless of the length.

—R. H. Pfetzing, Moline, Ill.

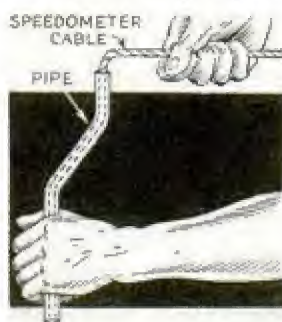
Small Coil Springs Wound Easily On Threaded End of Bolt

Needing a small coil spring occasionally in building models, I have found that a thin piece of steel wire and a small bolt enable me to turn out a neat miniature spring with little trouble. The wire is wound on the threads of the bolt, then tempered by heating it on the bolt and dipping it in cold water, after which the completed spring is turned off the bolt in the same manner as a nut.

—W. Golden, Jr., Newport News, Va.



Fuel Lines Cleaned Thoroughly By Using Speedometer Cable



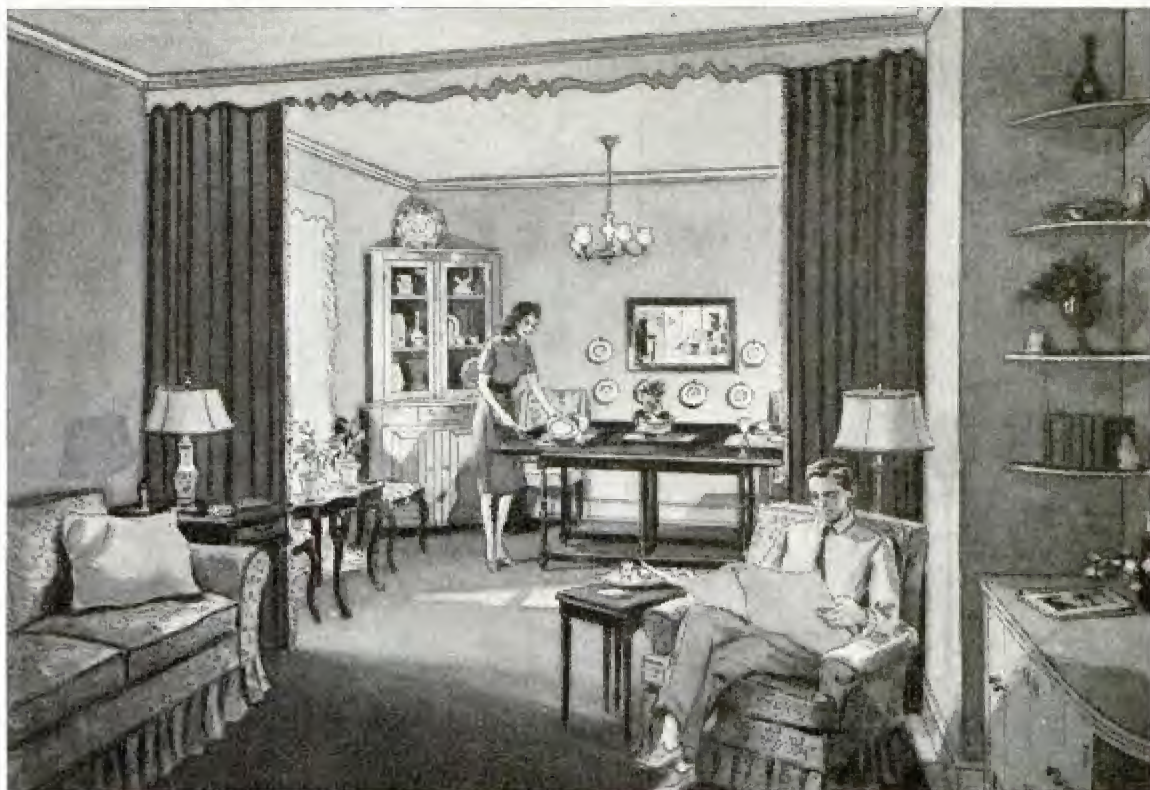
You will find that a length of speedometer cable is ideal for cleaning clogged oil or fuel lines. It is better than a length of wire, as it will follow the bends in the line without catching, and it is

safer than compressed air, which might burst the line. Of course, after the line has been opened with the cable, compressed air can be used to good advantage to remove all loosened particles, which might later cause the line to clog again.

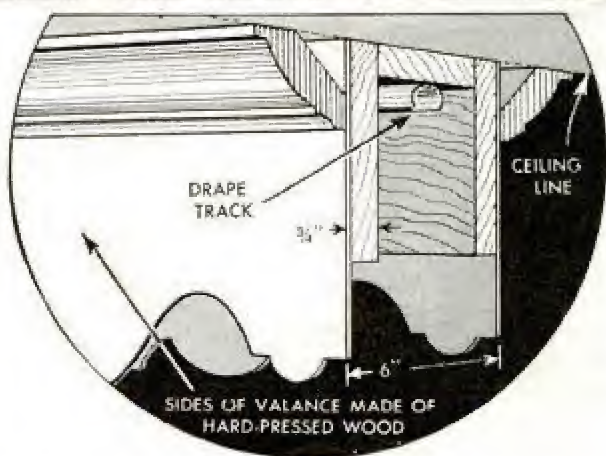
Growing Evergreens Successfully

When planting evergreens to improve the appearance of your home grounds, remember to plant them in well prepared soil, in plenty of time for the roots to get a good start before hot weather comes. Be sure to provide adequate drainage, and water the plants regularly. Also, loosen the topsoil during the summer months and mulch to prevent the soil from drying out.

Valance and Sliding Drapes to Separate Rooms



Drapes that slide on a track hidden inside a valance provide a neat, inexpensive method of separating living and dining rooms that are built to appear as one large room. Used in the U. S. Gypsum model research house, the valance shown above is not difficult to make. The drape track is mounted inside a U-shaped assembly, which is attached to the ceiling in an inverted position and finished with strips of cove molding on each side. As indicated in the circular detail, three 6-in. boards form the U-shaped assembly to which scrolled sides of hard-pressed board are fastened.



Realistic Hardwood Candles Won't Bend in Hot Weather

After experiencing trouble with ornamental wax candles bending, especially during warm weather, my son made some of wood, which look so realistic that they cannot be detected from regular ones even when handled. After turning the candles to shape and sanding them thoroughly, holes were drilled in the top ends to take

short pieces of string to simulate wicks. Then, the candles were painted the desired shade and dipped in melted paraffin. The paraffin covers all of the brush marks and any other defects in the paint to give the surface a wax appearance, making them difficult to distinguish from real candles.

—S. E. Draper, Ottawa, Ont., Can.

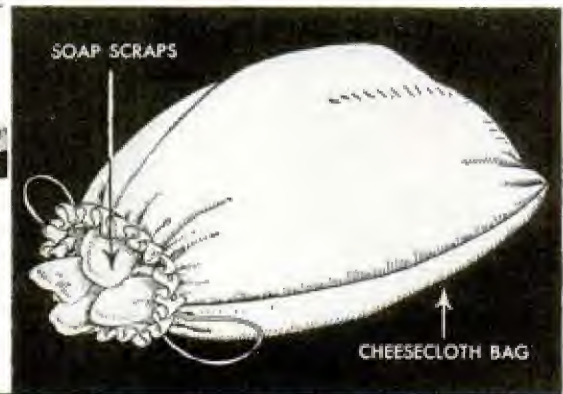
Solving HOME



If your veil has lost its crisp new appearance, it may be given a new lease on life by pressing it over a sheet of waxed paper. A moderately hot iron is all that is necessary, as too much heat will evaporate the wax. Veils given this treatment will stay fresh surprisingly long, and the procedure can be repeated



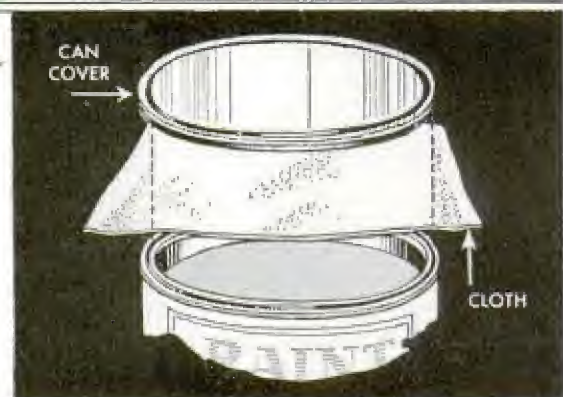
Beside holding the fingers steady while applying nail polish, this little wooden rack also keeps them spread well apart and makes it unnecessary to hold the hands in the air while the polish dries



Above: Soap pieces too small to be used alone can be saved in an empty tobacco sack or other small cloth bag, which is tied and used in the same way as a bar of soap. Left: Determine the age of an egg by placing it in the bottom of a bowl of cold water. If it lies on its side, it is strictly fresh. Standing at an angle, it is at least three days old; ten days old if it stands on end. Below: Paint collecting in the groove on the can top may be kept from splashing when the lid is replaced by covering the top with a piece of cloth, allowing it to hang over the sides. When the lid is put on, excess paint is absorbed



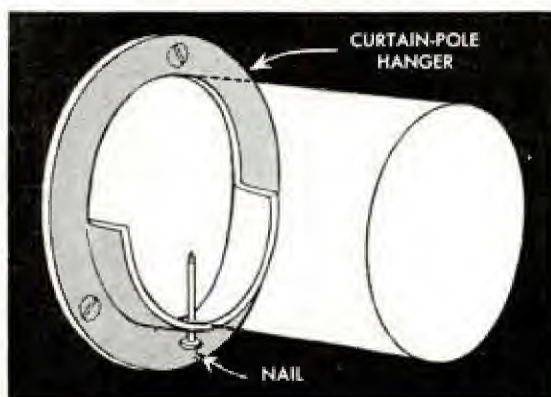
Rubbing a damp cloth sprinkled with salt over a wire clothesline will keep clothes from freezing to the line when hung on it during cold weather



PROBLEMS



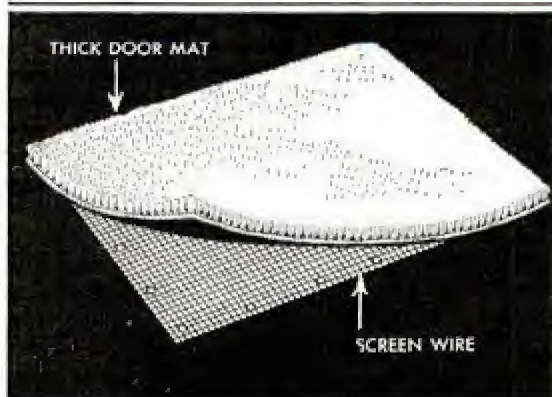
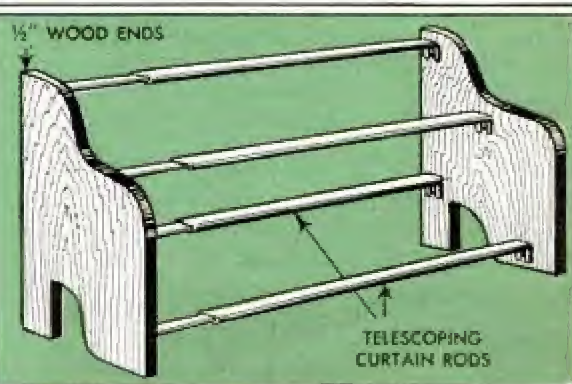
Too rapid drying of the soil around plants kept in clay pots can be avoided by painting the inside surfaces of the pots to prevent loss of moisture through the porous sides



Above: Wooden clothes poles in a closet often become so bent from long use that they slip from their sockets. To prevent this, drill a hole in the lip of one of the sockets, replace the pole with the bowed side up and drive a nail through the hole and into the pole. Held in this position, the pole will gradually straighten. Right: Sliding curtain rods screwed to ends of $\frac{1}{2}$ -in. wood will make a handy adjustable shoe rack. Below: A door mat can be kept from slipping if a discarded piece of screen wire of the proper size is tacked to the floor below the mat

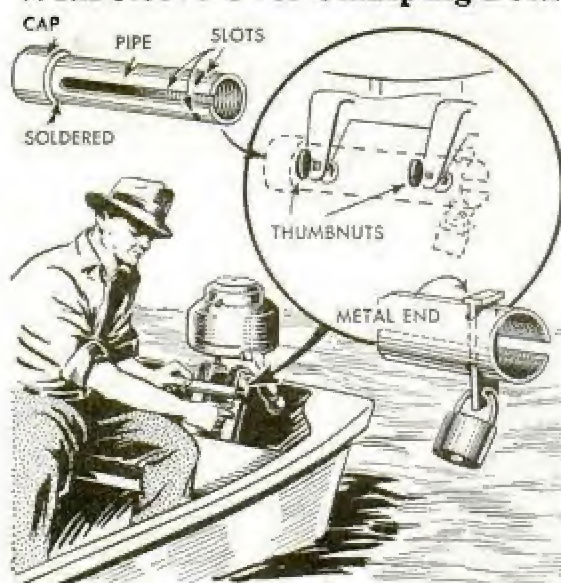


When vibration causes your electric clock to be extremely noisy, the noise can be reduced with strips of felt glued to the back in places where the clock has contact with the wall. You can further reduce the noise by slipping a rubber sleeve over the nail or screw from which the clock hangs



By looping friction tape on the last turn and passing the free end under the loop then pulling it tight, you can keep the free end from loosening

Theft of Outboard Motor Avoided With Sleeve Over Clamping Bolts



To make his motor fairly safe against theft when it is left on the boat unguarded for an hour or so at a time, one sportsman uses a metal sleeve, which he slips over the wing nuts or bolts that clamp the motor onto the boat transom. The sleeve is a length of pipe, which is slotted almost its entire length and capped at one end. Near the other end a piece of flat metal passes through a vertical slot to receive a padlock as indicated. In use, the nuts or bolts are turned with the wings in a vertical position, after which the sleeve is slipped over them, the flat metal inserted in its slot and the padlock put in place.

Pipe Cleaner in Spectacle Case Prevents Scratching Glasses

If you find it impossible to replace your spectacle case with a new one when the lining wears smooth from continued use,



bend a pipe-stem cleaner as shown, and fasten it in the case with a strip of cellulose tape. In this way, the lenses in your glasses will rest on the soft cleaner, thus eliminating any danger of them being scratched by hard particles of dust that might collect on the smooth lining.

Ink Capacity of Pen Increased By Using Ball-Head Pin

You can easily increase the ink-carrying capacity of a common pen point by using a ball-head pin. This is inserted into the holder along with the pen so that the head projects to within approximately $\frac{1}{4}$ in. of the end of the point. By actual test, this has increased the ink carrying capacity of some pens as much as 100 percent.



Car Spark Control Checked Easily Without Operating the Motor



Checking the action of the automatic spark control on your car without running the motor to produce vacuum can be done by using a hand tire pump. First, reverse the leathers in the pump so that it will suck air instead of compress it, and also, replace the hose with one 5 or 6 ft. long. Then mount the pump on a wooden base so that you can hold it down with one foot while pulling up on the handle to produce a vacuum in the spark control. In use, connect the hose to the vacuum line at the spark control or at the manifold, and remove the distributor cap. When the pump is operated, vacuum will be produced in the line and you can see whether or not the control is functioning correctly.

Etched Negative Produces Photo Greeting Cards

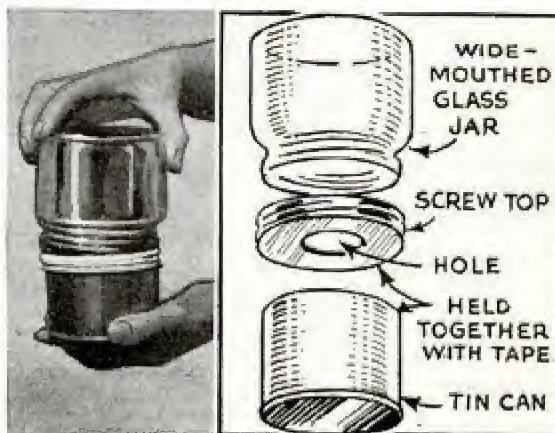


Unusual Christmas cards can be made photographically by scratching a design and greeting on a piece of thin, clear celluloid, after which printers' ink is rubbed into the lines and a print made in the same way as you would print a photo. If clear celluloid is not available, old negatives from which the emulsion has been removed with hot water will do. To make a negative, first draw the design on a piece of paper. Then tape or thumbtack the film

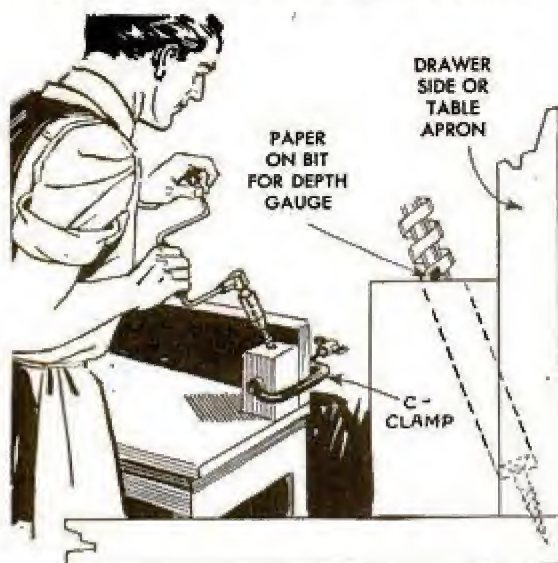
over it for easy tracing. Use a sharp-pointed instrument for a stylus, such as a phonograph or sewing-machine needle, which can be held in a dowel or an automatic pencil. Innumerable effects can be had by arranging the lines in various ways. After the ink has been rubbed into the lines, remove the surplus with a cloth, leaving it only in the etched lines. Make a print on glossy paper and mount the finished picture on a colored card or a neat folder.

Tender Seedlings Grown Easily in Miniature Greenhouse

Permitting easy control of moisture and temperature, this inexpensive Wardian case, which in a small way serves the same purpose as a greenhouse or hotbed, will help you grow vegetable and flower seeds successfully. You will find the case especially handy when germinating begonia and other seeds that require careful control of moisture. Usually plenty of warmth will be provided by keeping the case near a stove, radiator or heating plant. The case is made from a tin can and a wide-mouthed glass jar, held together with tape or by soldering the jar top to the can. A wide-mouthed fruit jar with a self-sealing top having a removable center is ideal.



Uniform Screw Pockets Made By Using This Simple Guide



If you experience trouble in forming screw pockets that are necessary when assembling drawers or when screwing the sides or aprons to cabinet tops, this guide will help you keep the auger bit at the correct angle while countersinking the work to form the pockets. The guide consists of a wood block having a $\frac{3}{4}$ -in. hole drilled through it at an angle of 25 to 30 degrees. When a number of pockets are to be made at the same height from the lower edge of the work, or from the bottom of a drawer, make the block of sufficient length to reach the edge of the work or drawer bottom in order to make all the pockets at a uniform height.

Burning Time of Candle Limited With Heated Knife Blade

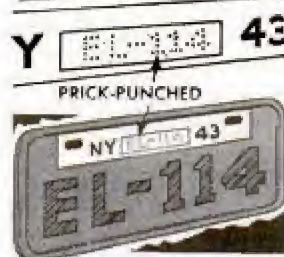
Next time you are on a camping trip and want to limit the burning time of a candle,



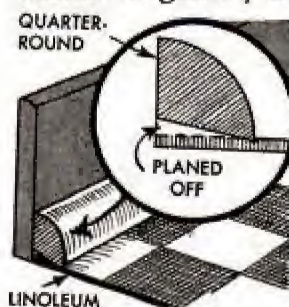
warm the small blade of your pocket knife and cut the wick at the desired point. In this way, the upper section of the candle will burn down to the point where the wick is severed and fall over, thus extinguishing itself.

Prick-Punching License Strips Prevents Use If Stolen

As my new car license plates this year consist of only narrow strips of metal carrying the year and state name to be attached to the old plates, I prick-punched the license number into the strips. This discourages theft as the number punched in them would not correspond with the numbers on the plates of other cars.—Geo. W. Jolls, Elmira, N. Y.



Joint Between Wall and Linoleum Made Tight by Beveled Molding

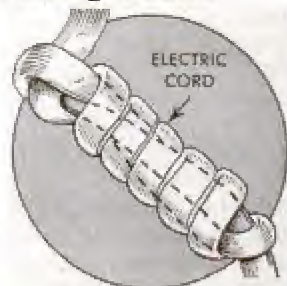


One workman employs a simple trick to make a watertight joint between linoleum and the quarter-round strips at a wall. The bottom of each strip is planed at an angle so that, when nailed against the

baseboard, the edge imbeds itself into the linoleum to make a snug fit. This should be done only on linoleum that is cemented to the floor as new linoleum laid loosely usually expands, and when held at the edges is likely to buckle.

Electric Lamp Cords Shortened Without Cutting Them

Where it is advisable to shorten electric cords on lamps to prevent them from sagging or becoming tangled on the floor, here's an easy way to take up the slack neatly without cutting the cord. Just double the cord near the center and wrap one end around the two thicknesses up to the loop as shown. Then slip



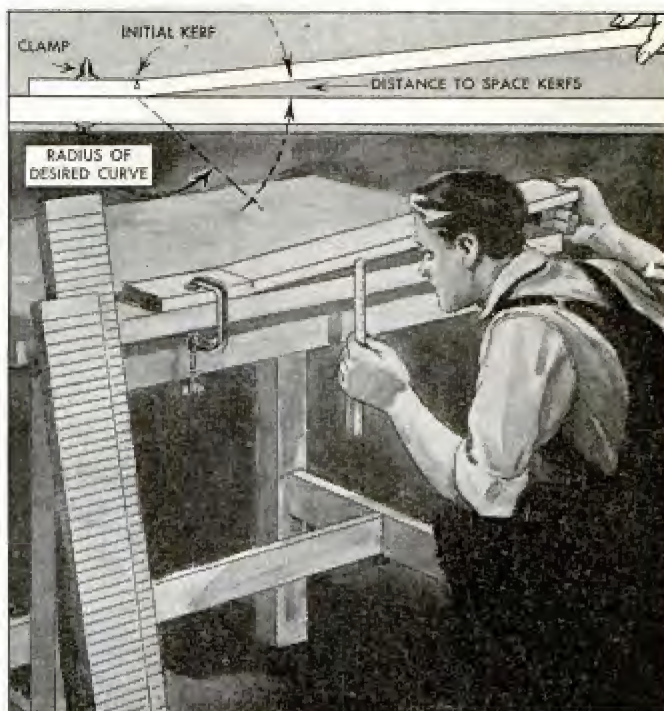
the cord end through the loop and tighten it by pulling on the opposite end of the cord. Of course, the number of turns wrapped around the doubled cord determines the amount of slack taken up.—W. Johnson, Amherst, Mass.

Auxiliary Stove Saves Oil When Supply Is Limited

Where fuel is difficult to obtain for circulating-type oil heaters and it is advisable to provide a small wood-burning stove for limited use, efficiency of the auxiliary stove can be increased considerably by hooking it up as shown. To connect the small stove, a double thickness of asbestos paper is cut so that it will slip over the pipe elbow and fit snugly inside the heater-door opening. A metal stove-pipe collar is then pressed against the asbestos filler and door frame to improve the appearance and provide a tight fit around the pipe. As a means of covering the burner bowl in the oil heater is needed, this can be accomplished easily, in many cases, by using the round cutout portion from the asbestos filler, a long wire being attached to the center of the disk to facilitate removing the cover whenever desired. Although not absolutely necessary, a damper installed in the stovepipe will result in better control of the fire and greater heating efficiency.



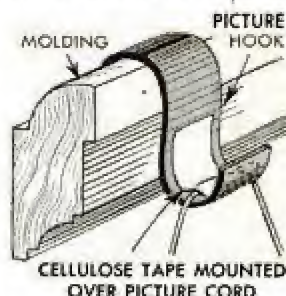
Uniform Bends in Wood Assured By Spacing Kerfs Equally



As uniform spacing between saw kerfs is essential if a good job of wood bending results without steaming, the kerfs should be spaced so they will all be closed at the top when the desired curve is formed. To get the proper spacing, saw an initial kerf and mark the board at a point from the kerf equal to the radius of the bend to be made. Then, after clamping the board to a bench top or other suitable surface as shown, grasp the end and bend it up until the kerf closes at the top. The distance between the lower edge of the board and bench top at the radius point will be the amount each kerf is to be spaced. All kerfs, including the initial one, should be cut about $\frac{5}{8}$ in. deep in the case of $\frac{3}{4}$ -in. stock.

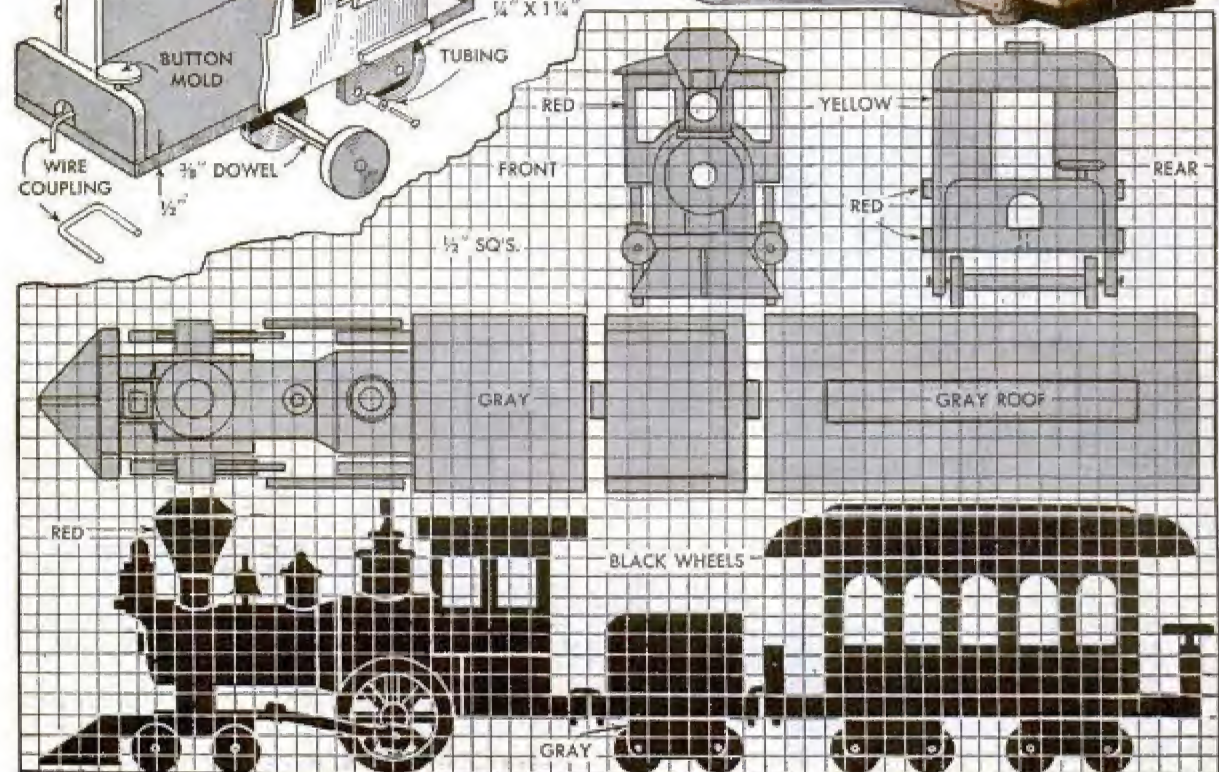
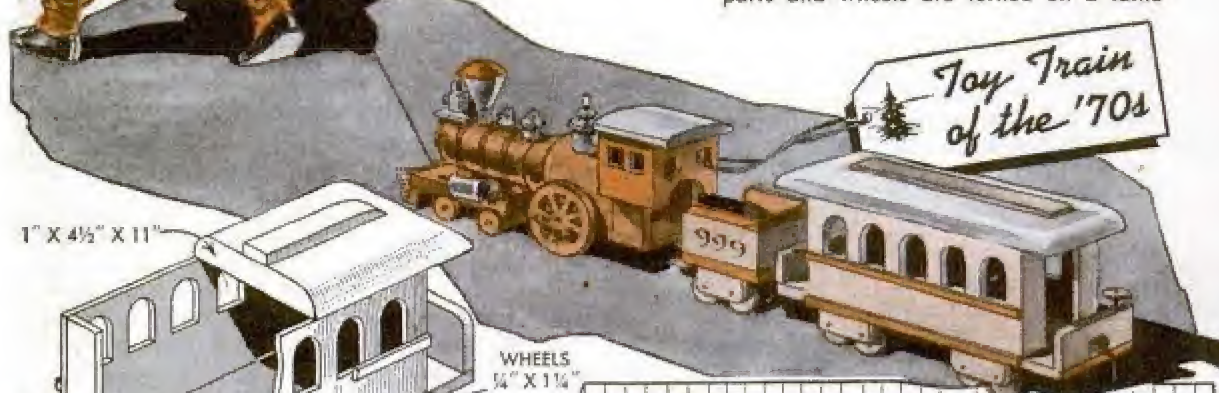
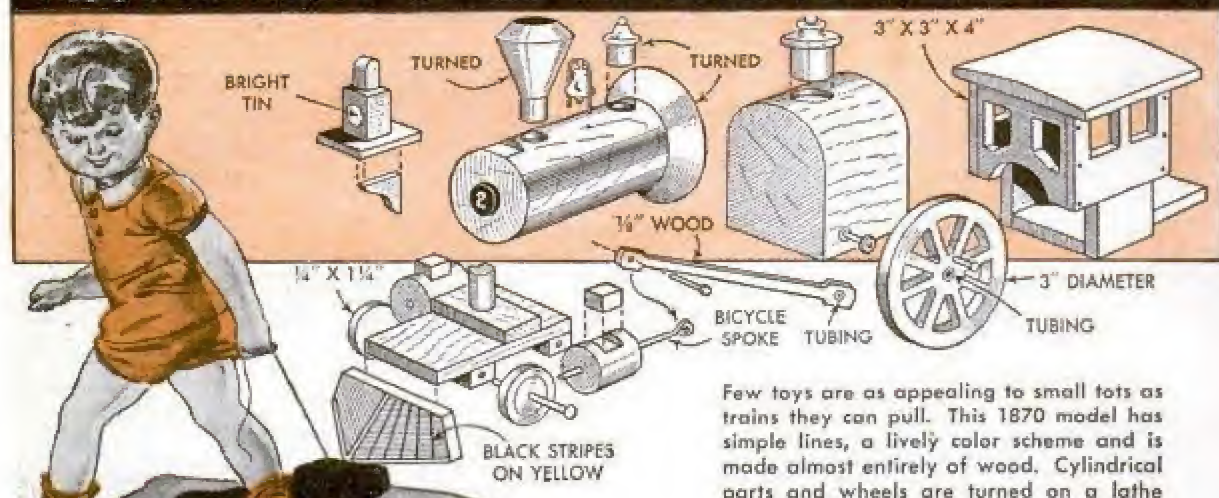
Tilting of Pictures Prevented By Tape Over Hooks

You won't have to worry about pictures sliding on hooks of the type shown if strips of cellulose tape are applied where the cords or wires pass over the hooks. This anchors the cords securely and prevents any slight jarring from causing the pictures to tilt. The cords can be shifted easily, if desired, by loosening the tape.



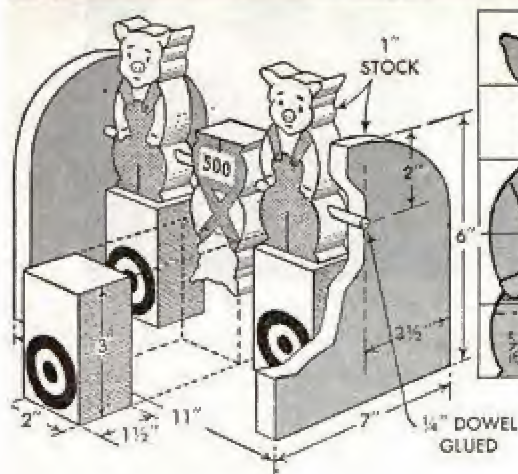
Homemade CHRISTMAS GIFTS

ASSORTMENT OF 25 APPEALING ITEMS YOU

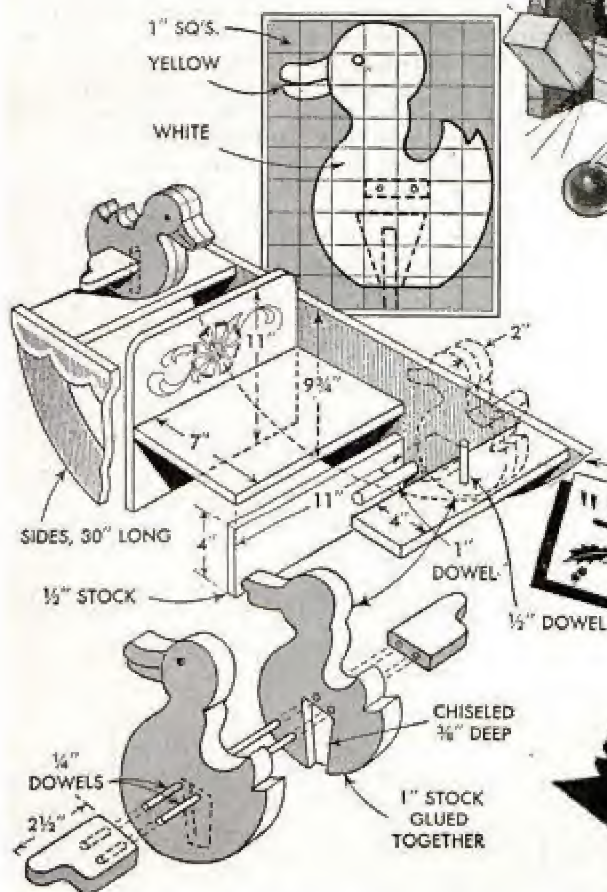


for Young and Old

CAN MAKE OF SCRAP MATERIAL

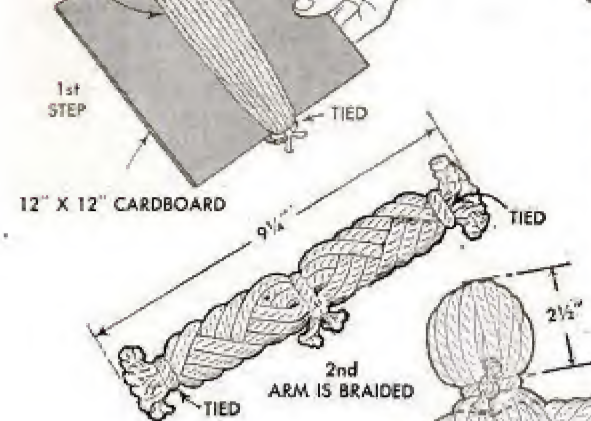
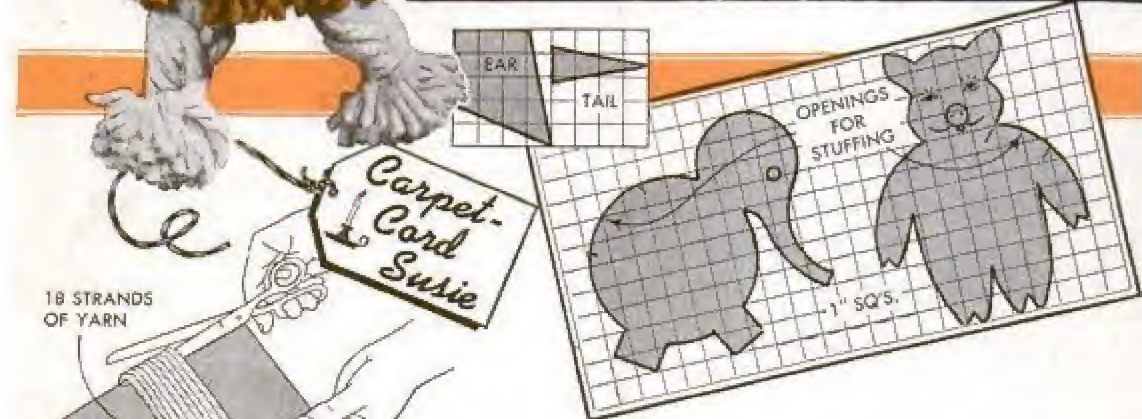
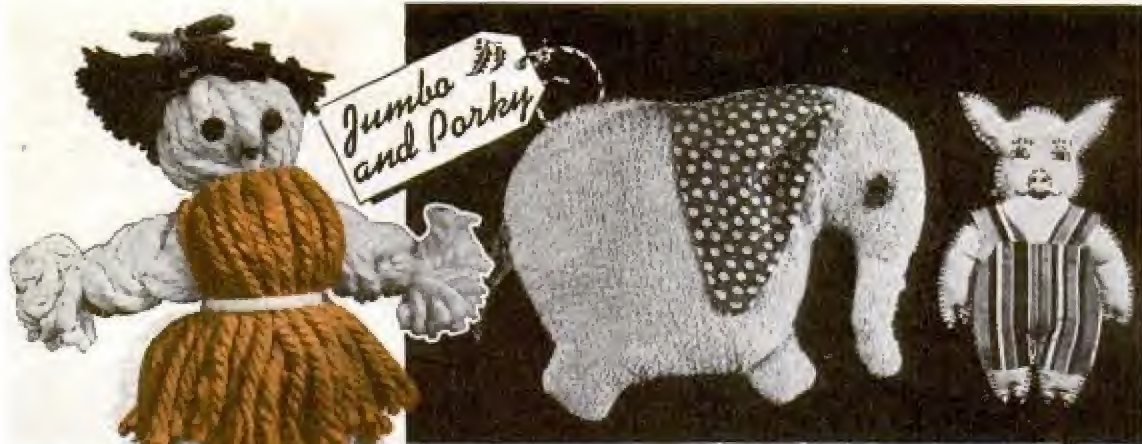


These little pigs are pivoted side by side on a rod or dowel and each one stands on a wooden block. To score, players try to knock away the blocks by rolling a ball. When this happens a pig spins around and comes to rest head down, displaying the score made. A number of these games can be made in a short time

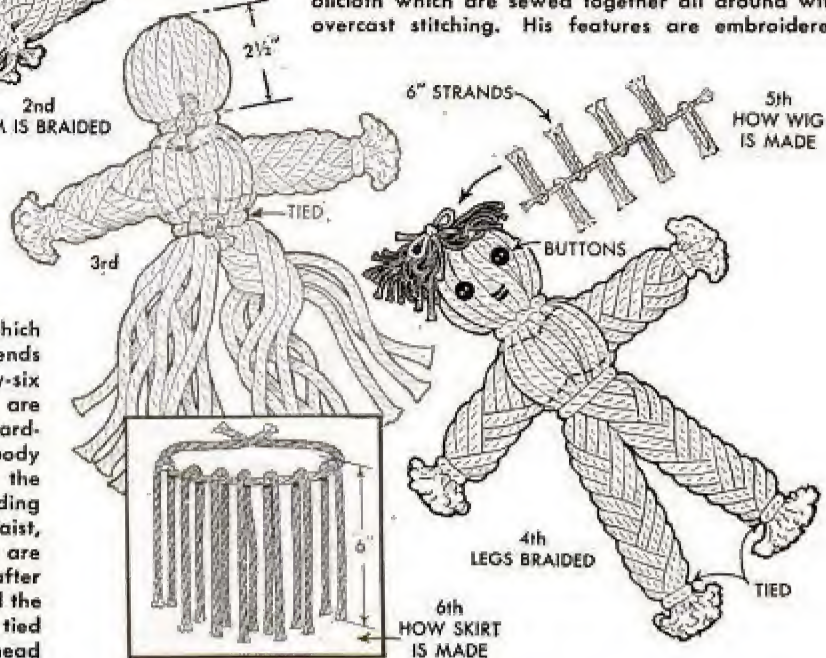


Besides just enabling small children to rock by themselves as is generally the case with play rockers, this one provides the child with a couple of animated passengers in the form of two small ducks. They wobble back and forth realistically while the child rocks, and keep it amused for hours at a time





As her name implies, Susie is made entirely of heavy carpet cord. Her one-piece arms are made by wrapping cord around cardboard, step 1, after which it is cut free and the loose ends braided as in step 2. Thirty-six strands, 18 on each side, are wrapped around the same cardboard to form the head, body and legs, through which the arms are slipped before binding tightly at the neck and waist, step 3. Then, the loose ends are braided into legs, step 4, after which the skirt is tied around the neck and waist and the wig tied in a bow to the top of the head



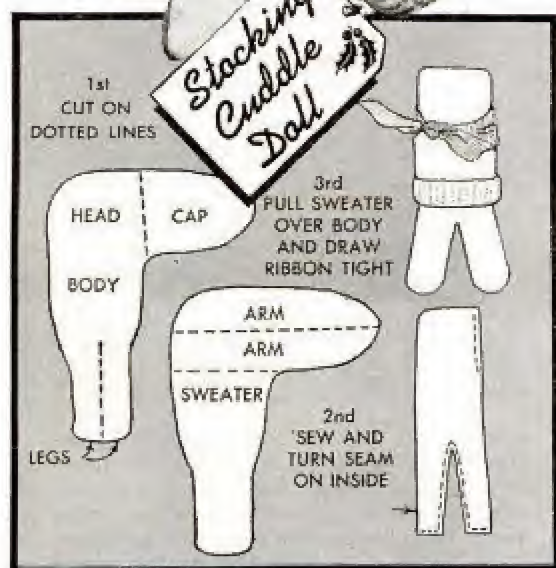
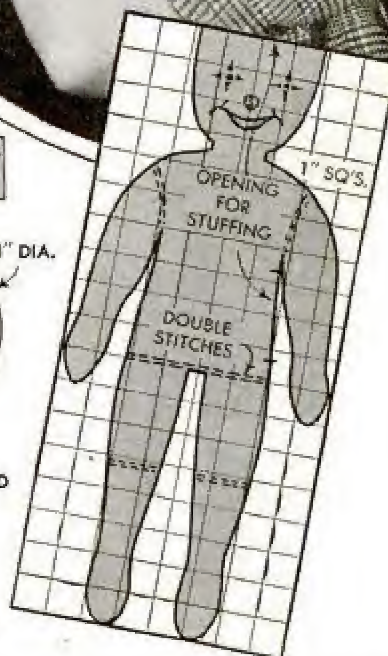
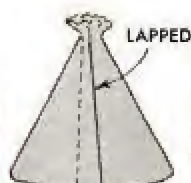
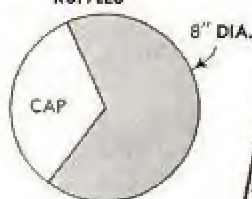
Soft cloth dolls will always be a favorite with small girls. All five shown on these pages are easily made from odds and ends found in most any sewing box. Jumbo's body is cut double from an old turkish towel, sewed together, turned inside out and stuffed, after which his polka-dot tail and large red ears are attached, and spots of ink added to represent eyes. Porky, wearing a pair of colorful cloth overalls, consists of a front and back of white oilcloth which are sewed together all around with overcast stitching. His features are embroidered

To make the amusing "Poncho," the squared pattern of his body must be enlarged full size. This is done by ruling on paper the same number of squares given, then simply drawing in the figure to coincide. Muslin, cut double, is used for the body, the two parts being stitched together around the edge except where openings are indicated for stuffing. Leg and arm joints are formed by double rows of stitches, $\frac{1}{4}$ in. apart, which are added as the stuffing progresses. His suit consists of two 14-in. square pieces of colorful cloth, which are sewed together, with openings being left through which to stick the hands and feet. Ruffling, gathered tightly at the ankles, wrists and neck, holds the suit in place. His cone-shaped cap is held on with a few stitches

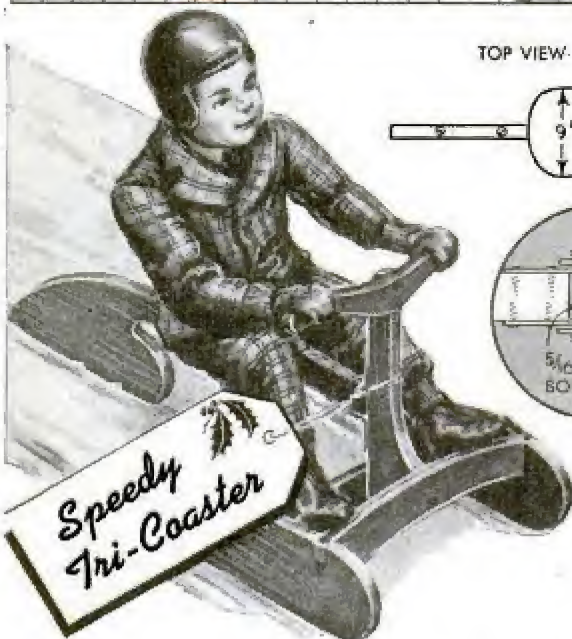
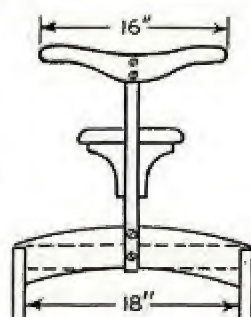
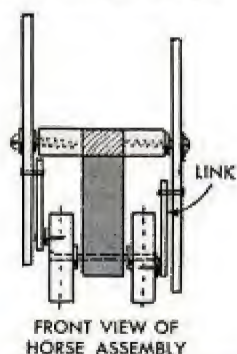
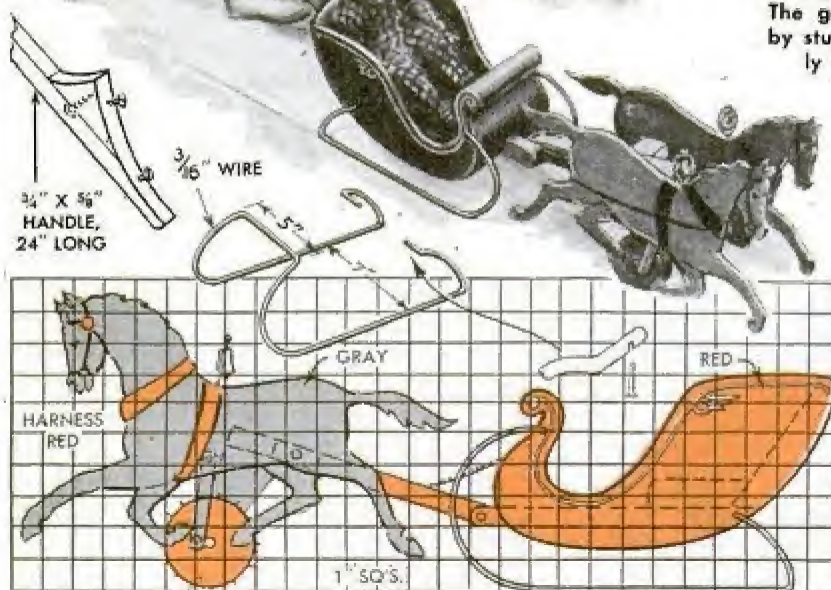
"Poncho"
the Clown



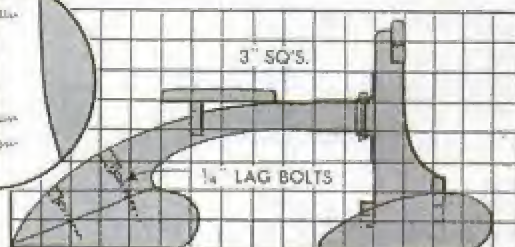
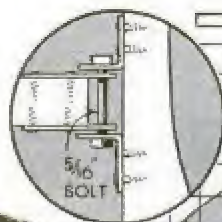
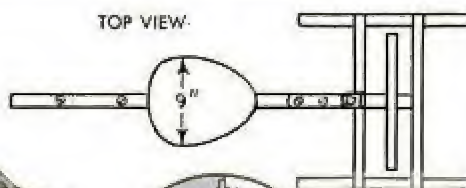
SHIRRED



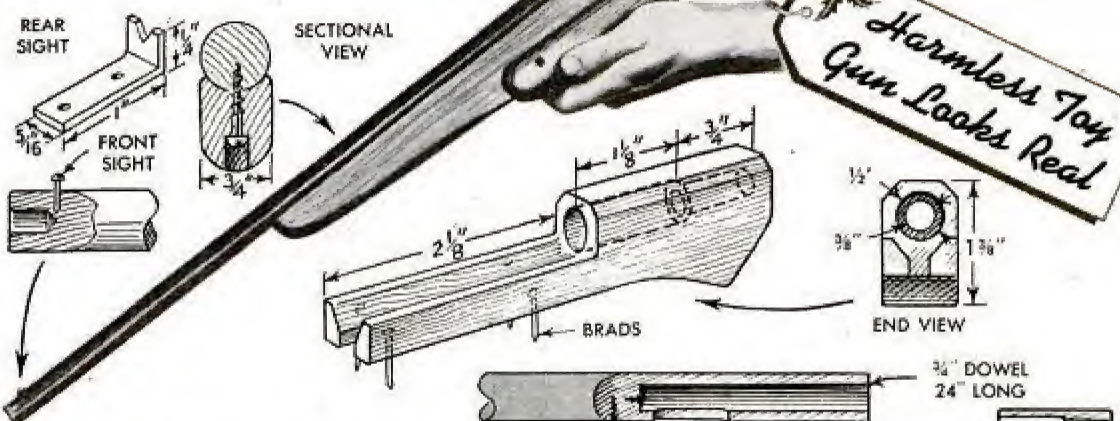
The cuddle doll is made of a pair of men's heavy cotton work socks. One sock forms the head, body and cap; the other, the arms and sweater. First, each sock is cut as indicated by the dotted lines and then stitched around the leg part, after which the sock is turned inside out and stuffed with cotton through the opening at the top. Next, the sweater part is pulled over the body and the ribbed top of it is rolled up to form a wide cuff. After this, the head is formed by drawing a bright-red ribbon tightly around the neck and tying in a large bow. The arms are stuffed and sewed to the body at the neckline, and then hands and feet are simulated by binding the ends of the arms and legs with thread. The doll is completed by gathering the cap in at the top to represent a tassel and adding the features, which are bits of red felt glued in place as shown in the photo



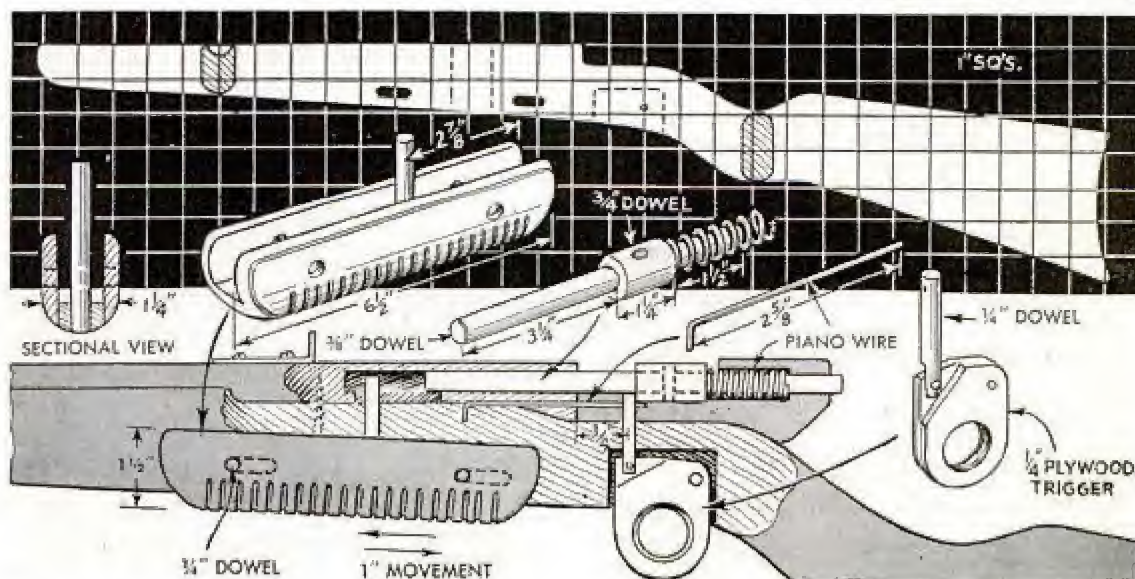
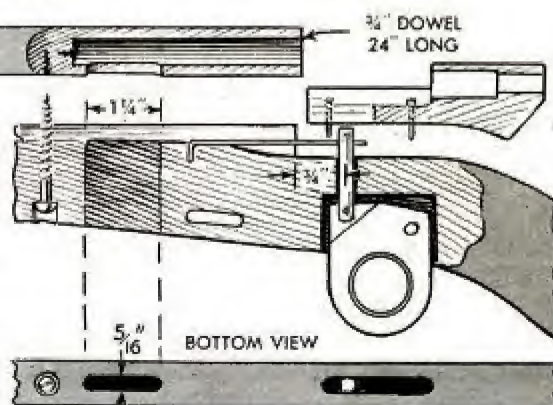
TOP VIEW.



Made entirely of wood, except for steel runner shoes if available, this speedy "tri-coaster" has minimum friction. The single rear runner, with seat attached, is pivoted to the front-runner assembly on which the rider puts both hands and feet for complete steering control.

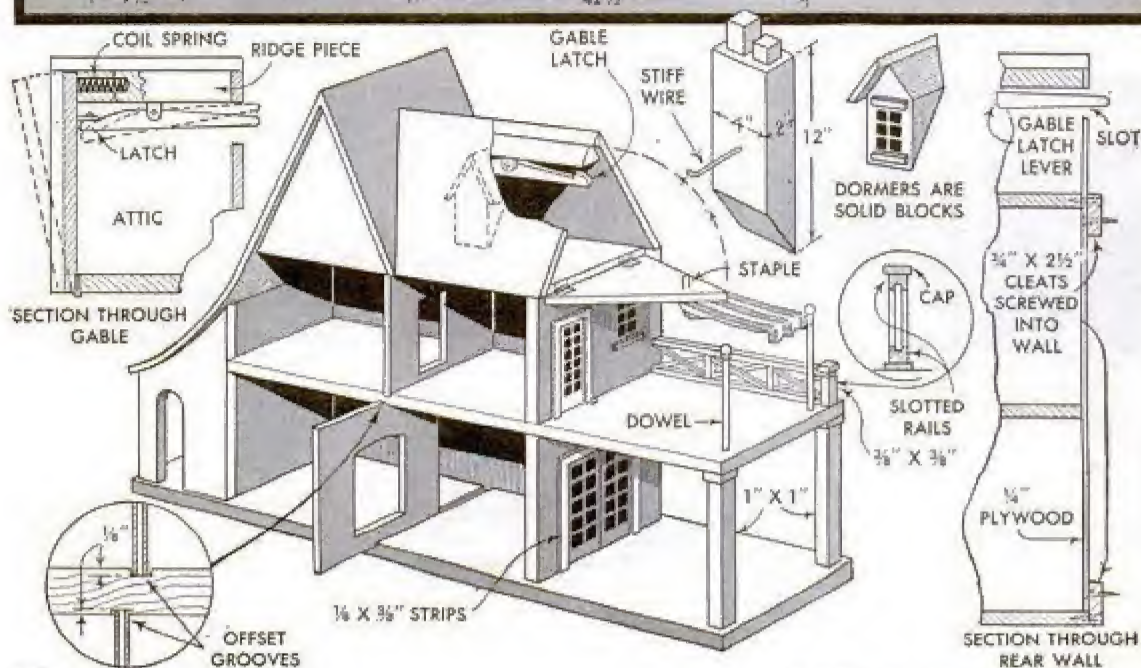
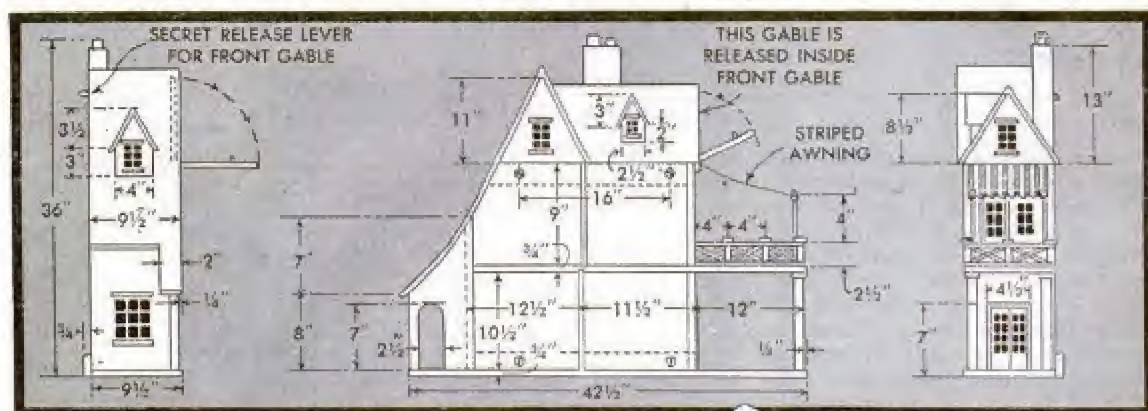


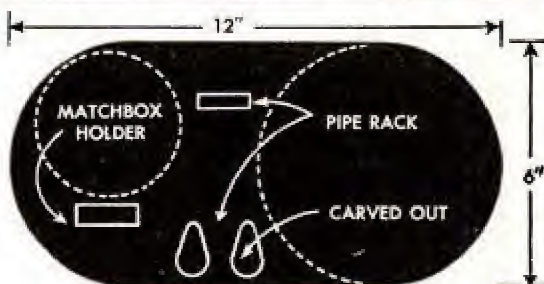
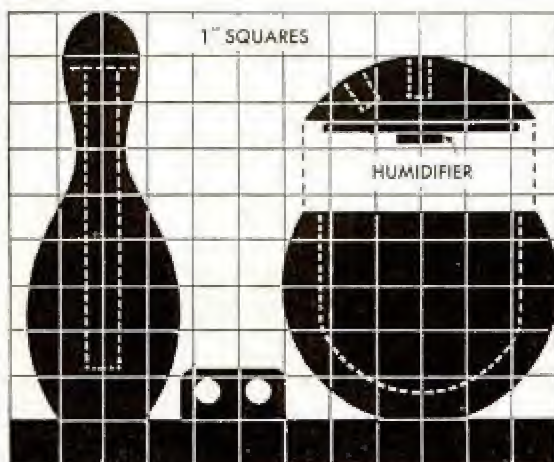
Any young "Commando" will get a thrill when he finds this dandy toy repeating rifle under the tree Christmas morning. Except for a spring and a few screws, it is made entirely of wood, yet it looks like the real thing. Best of all, it is perfectly harmless, as it simply "shoots" with a loud bang. The gun stock is cut from a $\frac{3}{4}$ -in. board and the top edge is grooved to take a dowel "barrel," the ends of which are bored as detailed. A trigger pin keeps the gun cocked and when released a spring sends a block against the end of the barrel to make a noise simulating the report of a rifle



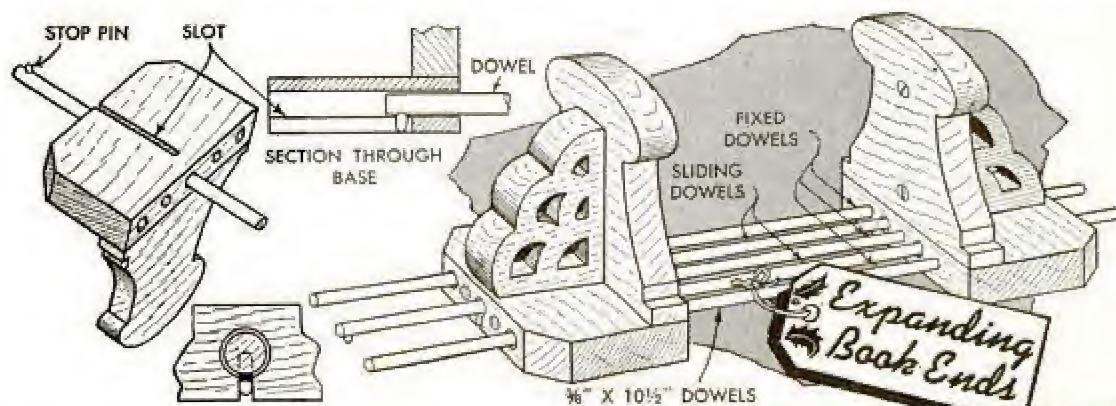


After your little girl outgrows this dollhouse, fond memories of playtime days will always remain vivid even though the dollhouse assumes new usefulness as a bookshelf. Built narrow to conform to bookshelf width, it may be hung on the wall even as a dollhouse, although if made wider, it can be used on the floor. Pulling out the room partitions converts it into a bookshelf; the dollhouse treasure chest will then hold her jewelry

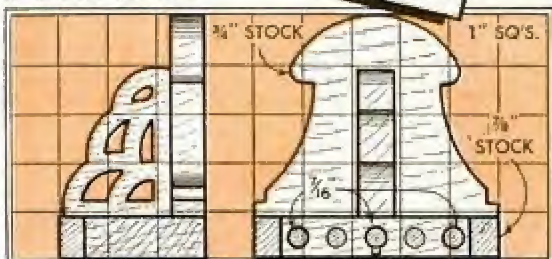


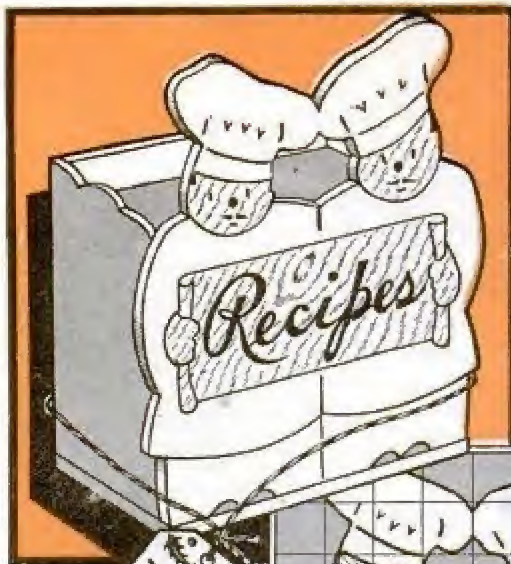


Anyone who likes to bowl will appreciate this walnut or maple smoking set, which has a humidifier shaped like a bowling ball with finger holes in the cover, and a pipe-cleaner holder shaped like a bowling pin, both being turned as indicated in the squared detail. If copper or other suitable metal is available, the humidifier and its cover should be lined. A match holder and pipe rack are provided on the base of the set



Adjustable to accommodate a few or many books, these expanding book ends will not slide askew. They are connected by five dowels, two of which are fixed in one book end and three in the other one. A stop pin at the outer end of the center dowel works in a slot in the base of one book end as indicated to prevent the assembly from being pulled apart accidentally. Felt should be glued to the base to prevent marring table tops

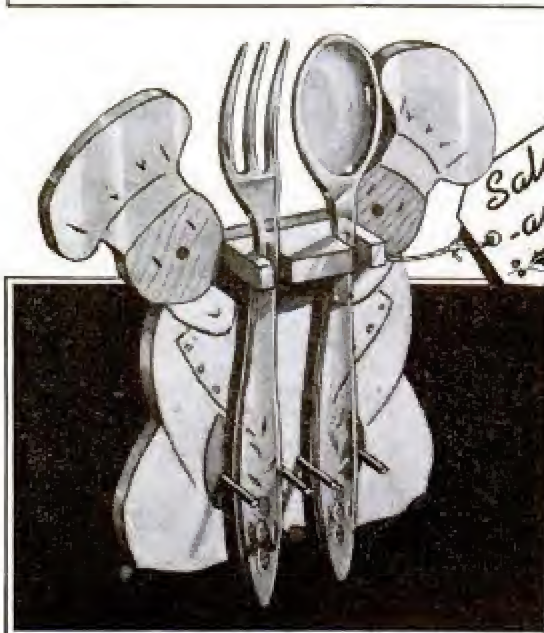
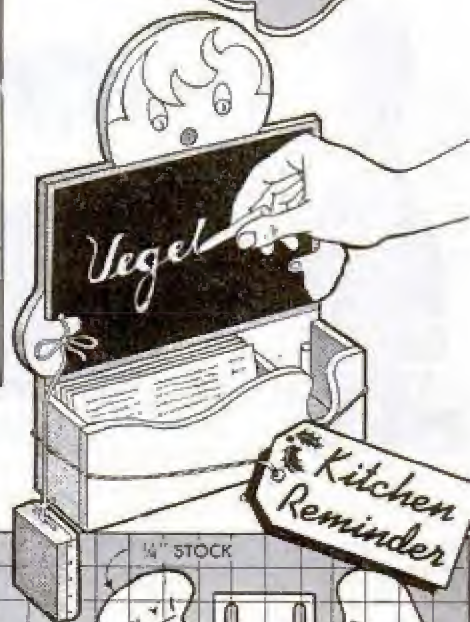
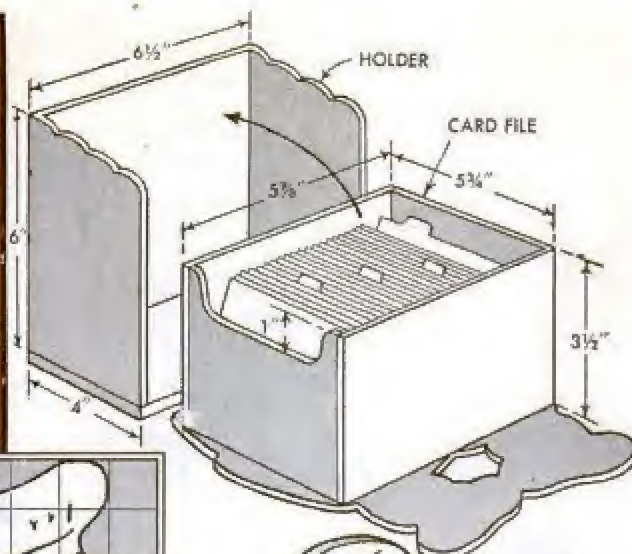




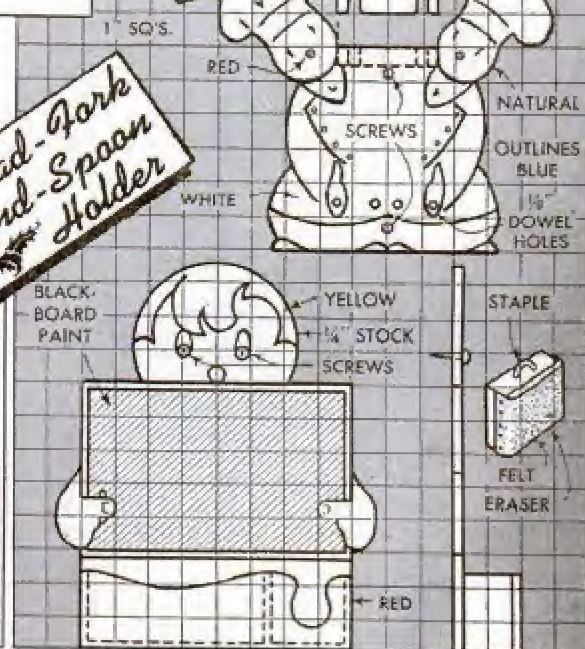
*Twin-Chef
Recipe File*

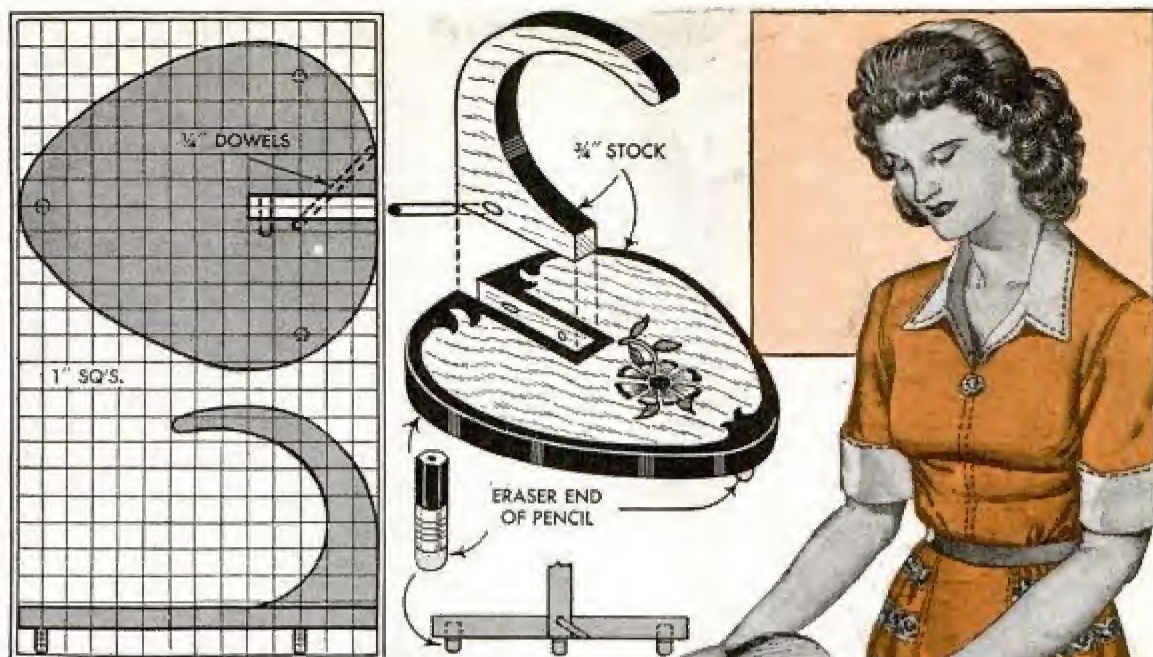


Two chubby chefs guard the above recipe file, which stands on its side when not in use, and a saucy little face watches over notations made on the kitchen reminder shown at the right. The little chefs at the bottom will provide a humorous touch as they patiently hold a large wooden fork and a spoon.



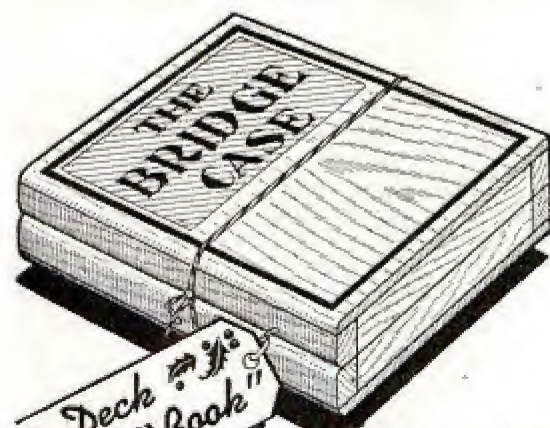
*Salad-Fork
and-Spoon
Holder*



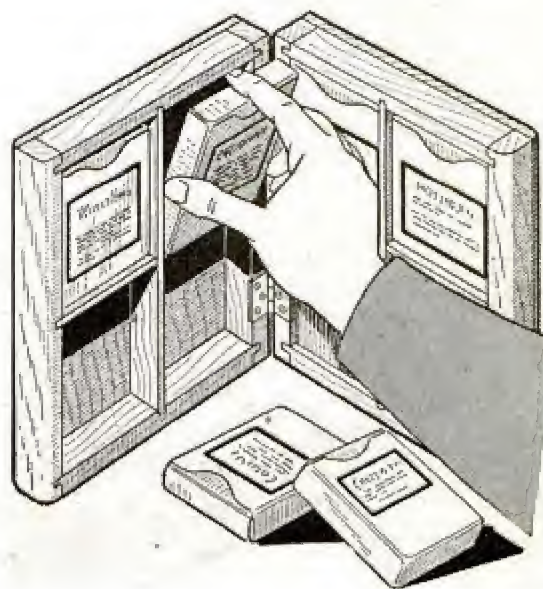
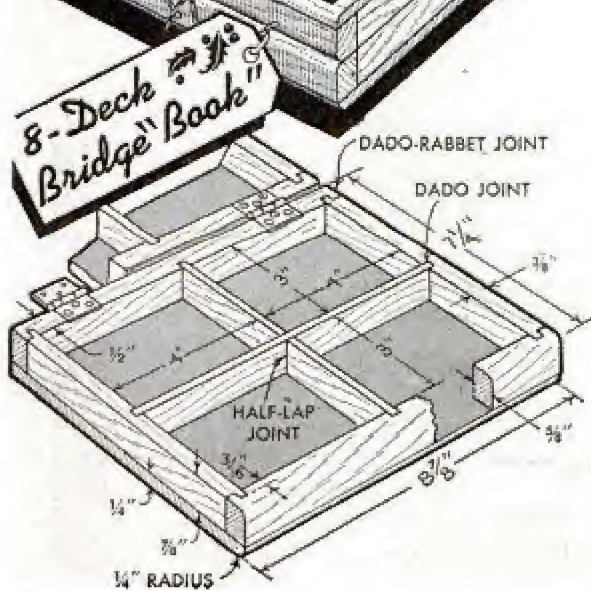


The unusual design and the hooked shaped handle that make this tray easy to balance and carry with one hand, will please the most discriminating hostess. - Novel rubber feet are provided by cutting off the eraser ends of lead pencils and inserting them into holes on the underside of the tray at the three corners

One-Hand Beverage Tray

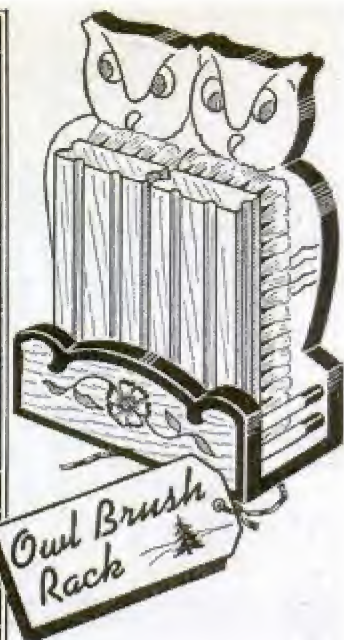
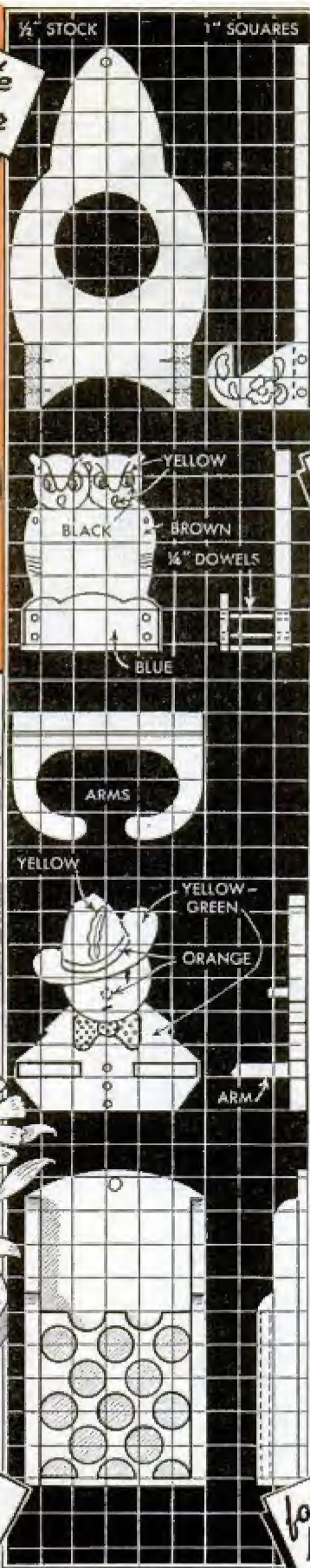


Having one side shaped to resemble the bound edges of two books, this bridge case can be kept inconspicuously in a bookcase where it is always at hand. Although each half of the case is made to hold four decks of playing cards, one half can be partitioned to accommodate pencils, score pads and other playing-card accessories if desired

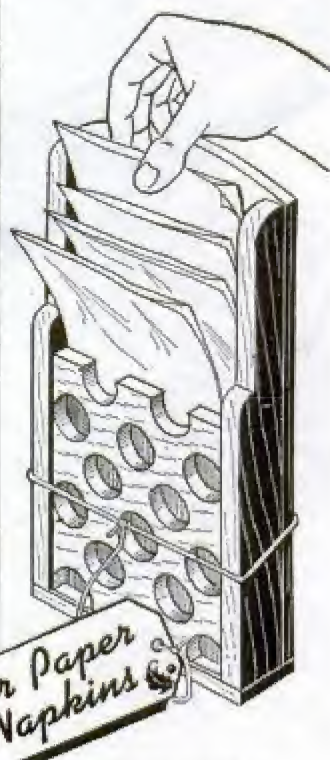


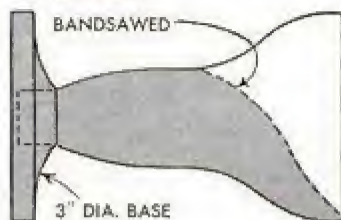
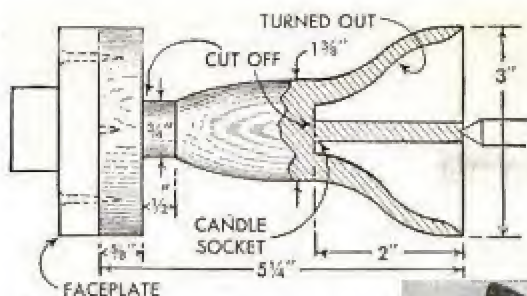


Prized plates will be displayed to good advantage if decorative hangers like those shown above are used. Painting designs on the hanger arms to harmonize with those of the plates enhances the appearance of the hangers. Tirelessly hugging a couple of potted plants against his chest, the little flower boy below will solve the problem of where to keep small potted flowers that every woman likes to have. The drab appearance of the pots can be brightened by the use of a little paint

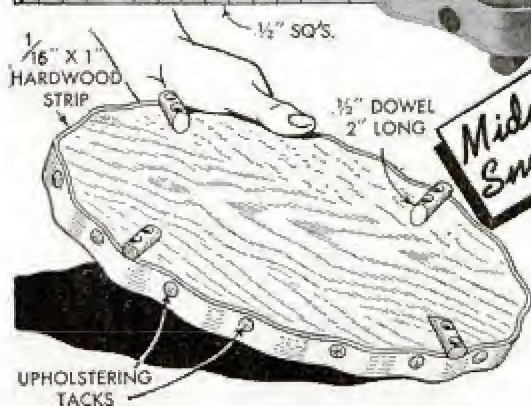
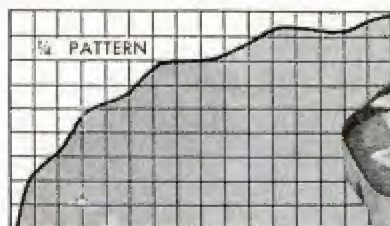


There'll be no "hootin'" over misplaced kitchen brushes when the two wise old owls above keep them safely in view. Anybody will appreciate the ease with which paper napkins or towels can be removed from the holder below. The perforated front adds a decorative touch to the holder, which is painted to match the color scheme of a kitchen or a bathroom



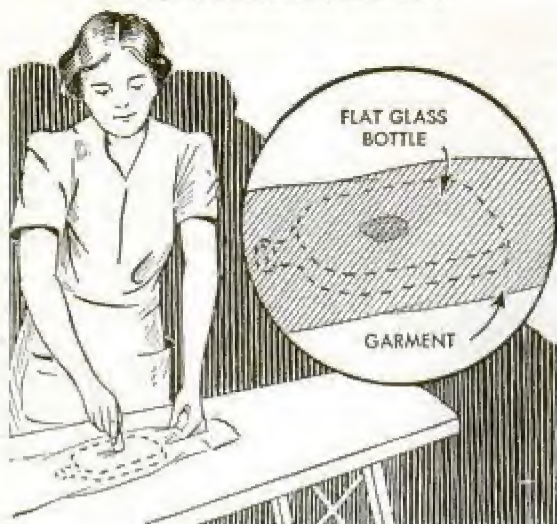


Shaped like the flowers of graceful cala lilies, these candlesticks are suitable in any table setting. They are turned and sawed as indicated in the details, and then are finished with two coats of shellac, rubbing down the work with fine sandpaper between coats. Thin felt glued to the bottoms of the candlesticks will prevent marring highly polished table tops



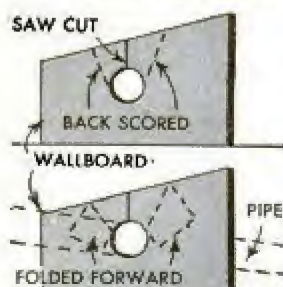
Anyone who likes a midnight snack of cheese and crackers, will find this tray suitable for the occasion. It is made by gluing together 1/2-in. pine and 1/4-in. birch and then binding the edge with a hardwood strip or splint, which must be soaked in water to make it pliable before tacking in place

Flat Glass Bottle Aids in Cleaning Garments at Home



By simply inserting a flat glass bottle in the sleeve of a garment when using cleaning fluid to remove spots, you can eliminate the danger of soiling the opposite side of the sleeve. Also, this glass surface keeps such fluid in the fabric so that only a small amount is needed to do the work.

How to Cut Heavy Wallboard To Fit It Around Pipes



Cutting heavy wallboard so that it can be fitted around a pipe without making the opening appear unsightly can be done easily as follows: First, make the hole for the pipe at the required location. Then saw from the edge of the board to the hole, next score the back of the board deeply from the hole to the edge of the board as indicated. Now, fold the two segments back. Do this very carefully to avoid breaking them off. When the board has been inserted in place, fold the segments back into position and nail them in place. After the job has been finished, the only mark that will show on the surface of the board will be the saw cut.

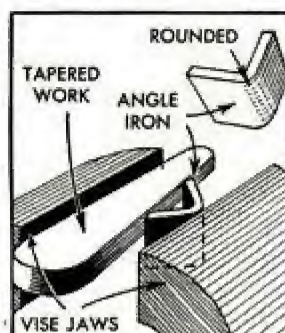
Old Suit Made Flame Resistant By Simple Solutions

Anyone who has need for flame-resistant clothing can treat an old suit for the purpose by dipping it in a solution consisting of sodium stannate, 3 lbs., and water, 1 gal. After wringing out, immerse the suit

in a second solution made by mixing ammonium sulphate, $\frac{1}{4}$ lb., with water, 1 gal. Then wring the material again thoroughly and hang up to dry. In tests with garments treated in this manner, they have withstood up to five dry cleanings without losing their flame-resisting qualities.

Gripping Tapered Work in Vise

The next time you have a piece of tapered work to grip in a vise, use a piece of angle iron between the work and one of the vise jaws as indicated. This will enable you to grip it firmly. For best results, round one edge of the



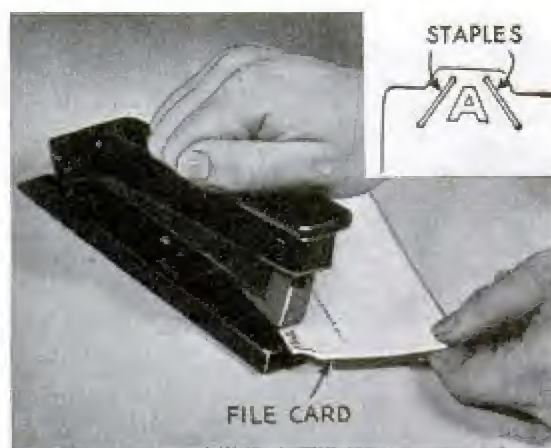
iron as shown, which will allow it to adjust itself to the taper of the work.

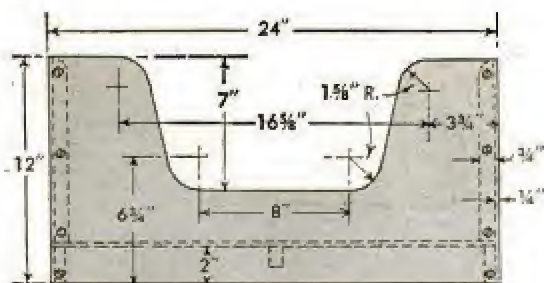
Life of Old Windshield Wiper Increased With Tire Paint

Being unable to obtain a new rubber blade for his windshield wiper, one motorist found that he could renew the old one to some extent by painting it with rubber tire paint. This not only renewed the blade, but it also provided the edge that contacts the glass with a softer and more efficient wiping surface.

Broken File-Card Tab Repaired With Paper Staples

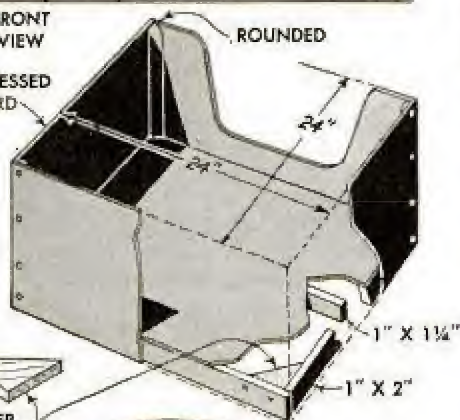
To repair or strengthen the index tabs of small file cards or dividers to increase their life, clinch two paper staples on each tab as shown. A strip of cellulose tape applied to the back will cover any sharp ends of the staples and avoid scratching the fingers when thumbing through the file.



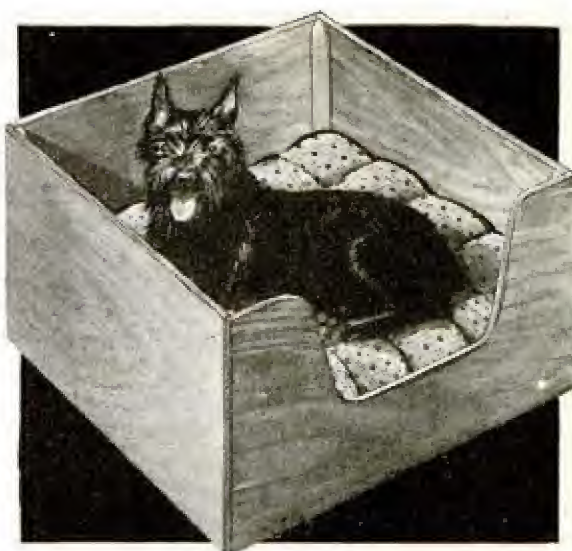


FRONT VIEW

HARD-PRESSED BOARD

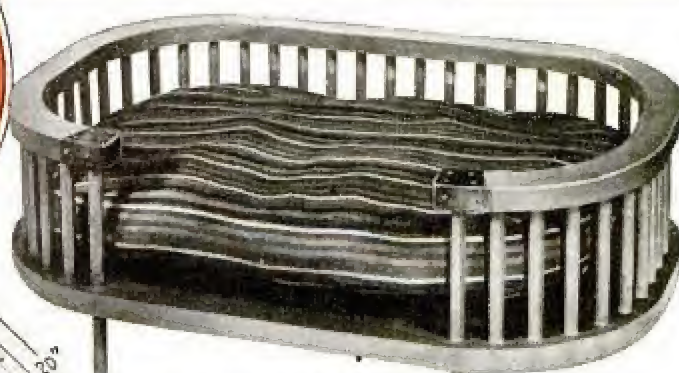
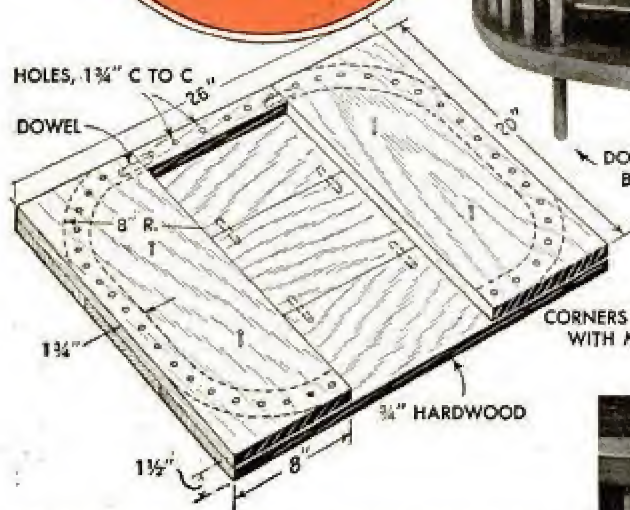


CORNER CLEAT



As dogs usually select a spot that is free from drafts when they want to rest, this simple bed is designed for their comfort and protection where they are trained to sleep on a porch or in the house near a window. Note that hard-pressed board is used almost entirely in constructing the bed, which has a raised bottom, instead of separate legs, to provide air space underneath

A BED for your DOG



DOWELS EXTEND 3" BELOW BOTTOM TO FORM LEGS

DOWELS ENTER RAILING 3/4"

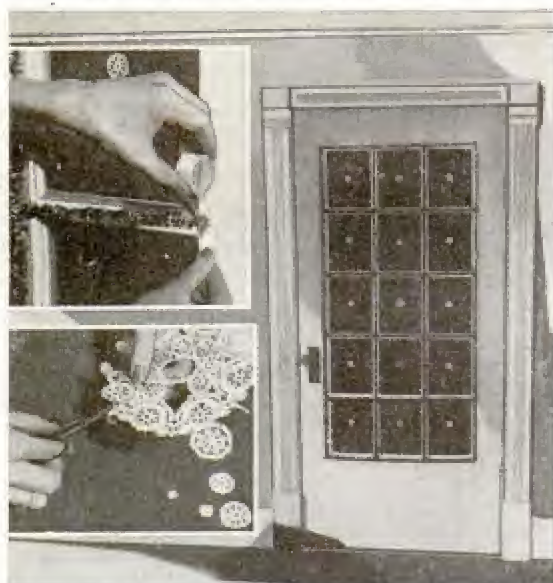
CORNERS CAPPED WITH METAL

1/2" X 8" DOWELS

Although this bed, the sides of which consist of dowels, was built for a cocker spaniel, dimensions given can be altered to provide plenty of room for a larger dog. When boring the holes for the dowels in the bottom and in the railing, tack or clamp the pieces together and bore both at the same time to assure the holes being in line. Note that four dowels are cut 3 in. longer than the others to serve as legs



Door and Window Decorations For the Holiday Season

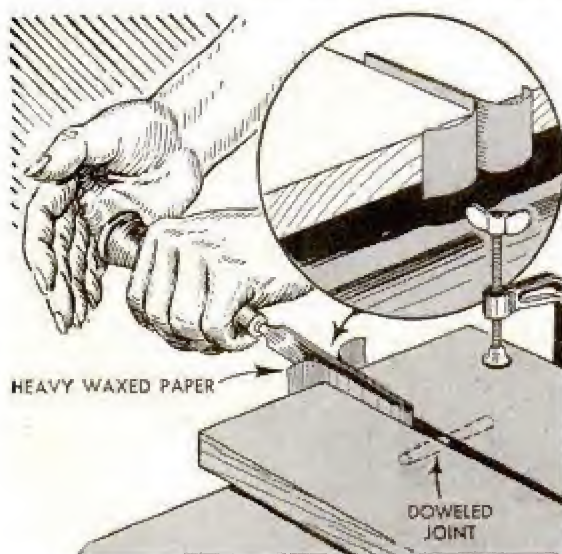


With a few pieces of glistening tinsel and several paper doilies, you can dress up your windows and front door to give a real holiday appearance. On the door shown, strips of red and silver tinsel were used to outline the dividing frames, strips of cellulose tape being applied over the ends to hold them in place. The imitation snowflakes were cut from lace paper doilies and attached to the panes with glue.

—Benj. Nielsen, Aurora, Nebr.

Doweled Joints Opened Easily Without Marring the Wood

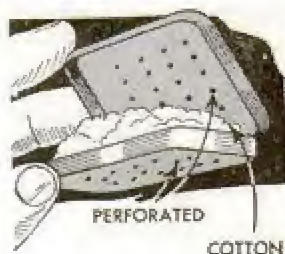
Have you ever wished that you had some way of opening a doweled joint without marring the wood after you had clamped it up for a trial fit? If you have, insert



folded strips of waxed paper in the joint at both ends as indicated before you tighten the clamps. Then, after loosening the clamps, insert the edge of a chisel into the joint between the paper strips and tap it in with your hand. In this way, a joint can be opened without leaving a mark.

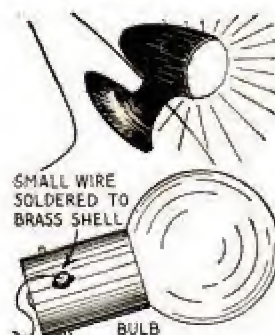
Humidifier for a Tobacco Pouch Made From Aspirin Box

To keep tobacco moist, a convenient humidifier can be made in a few minutes by perforating the lid and bottom of a metal aspirin box and then filling this with absorbent cotton. In use, just dip the box in water, and, after removing the excess by shaking, drop the box into your tobacco can or pocket pouch.



—C. W. Orwig, Browning, Ill.

Jumper Wire on Tail-Lamp Bulb Assures Electrical Contact

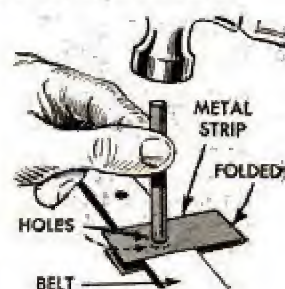


As the tail lamps on most cars are grounded to the car body or frame through the shell and mounting to complete the electrical circuit, rust and other corrosion between the parts often sets up a high resistance to the passage of

current, causing the light to be dim or not burn at all. A good way to overcome this trouble is to solder one end of a small wire to the base of the bulb and connect the other end to some part of the car where good contact can be made. Usually the frame is the best place to attach the wire.

Improvised Punch for Leather And Other Soft Materials

Having occasion to punch a number of holes in several leather belts where a hand punch was not available, I did the job with a strip of metal and an old twist drill. After

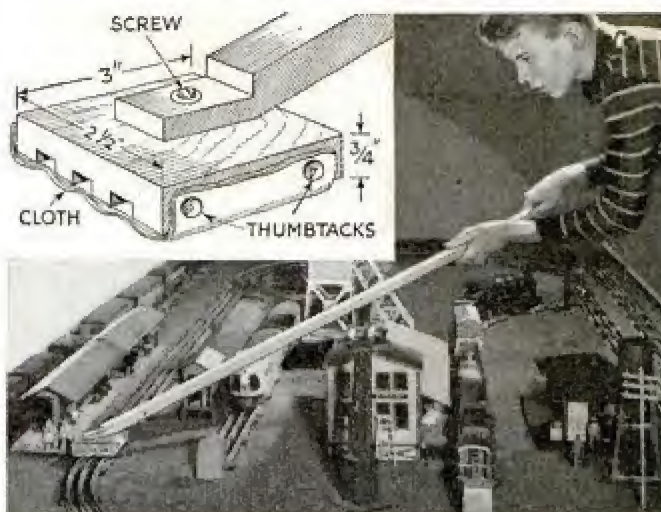


bending the metal as shown and drilling through it, the discarded drill was broken off and ground flat on the end to provide sharp cutting edges. In use, the belt or other material to be punched, is slipped between the two thicknesses of metal and the sharpened drill is driven through by tapping it lightly with a hammer, making a neat hole.—J. L. Wyndowe, Toronto, Ont., Can.

Dark Closet Is Best Place To Store Fabrics

According to results of a four-year test conducted by textile scientists of the U. S. Department of Agriculture, the best storage place for fabrics is not the average attic, but a dark closet on a lower floor. Most attics become very hot in summer, and heat has been found to cause deterioration of stored fabrics. Tests were made with both new and desized cotton sheets and degreased woolen samples stored at 102 degrees F., the average attic temperature, and at room temperature. Although changes in these fabrics were not enough to make them unserviceable, they became weak, and cottons and linens yellowed.

Track "Brush" for Toy Railroads Makes Cleaning Easy

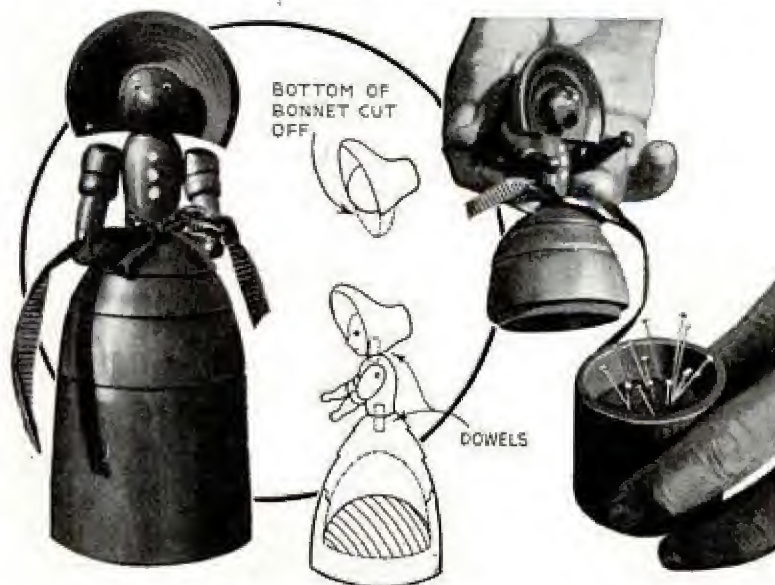


Keeping a large model-railroad layout clean is no problem if you have a track cleaner like the one shown. A long handle enables you to reach any part of the track with ease, and cloth-padded grooves in the cleaner permit easy removal of dust. The "brush" portion of the cleaner consists of a wood block grooved to fit over the three rails of the track. These grooves are covered loosely with three or four thicknesses of soft cloth, which are tacked to opposite sides of the wood. In use, the cloth is moistened with a suitable cleaner and then moved along the track.—C. Elmer Black, Philadelphia, Pa.

Dainty Colonial Maid on the Dresser Hides a Pincushion

Besides being ornamental, this little wooden maid is a useful dresser piece as the skirt conceals a pincushion. It is turned from walnut or other hardwood that is par-

ticularly pleasing. The skirt is turned out of a piece 2 in. square, and then cut in two parts, which are recessed; the bottom one 1 in. to take the pincushion, and the top one $\frac{3}{4}$ in. to provide space for the pins. The lower part is $1\frac{3}{4}$ in. high and the top part $1\frac{1}{2}$ in. The waist and arms are turned from $\frac{1}{2}$ -in. stock. Head and bonnet are one piece, and the bottom edge of the bonnet is cut off as shown before the parts are assembled. Head, waist and the top piece of the skirt are doweled together and the arms are pivoted on long brads. After painting on buttons, mouth and eyes, the piece is finished with two coats of a mixture of linseed oil, 3 parts, and clear shellac, 1 part.—Elma Waltner, Hurley, S. D.

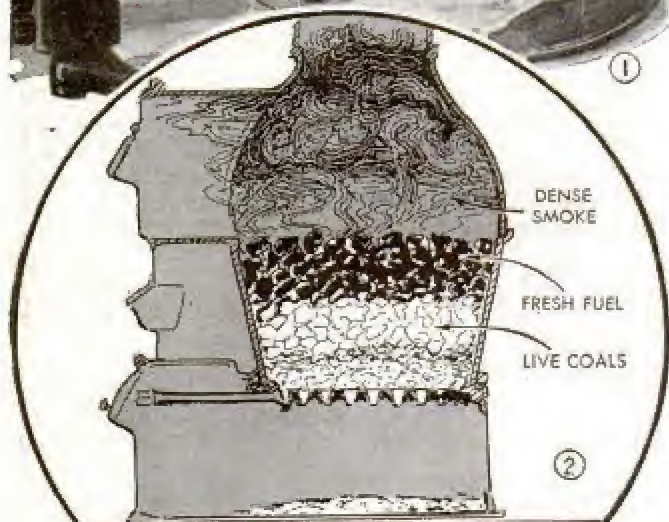


INSUFFICIENT HEAT

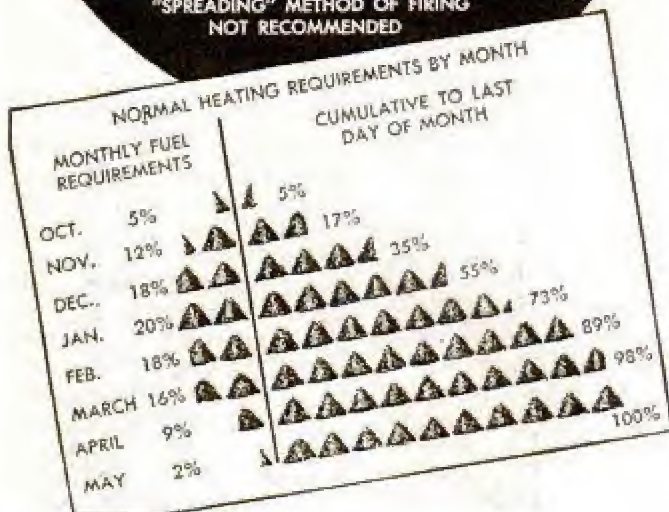
HAND FIRING

Getting at the causes of common
Helpful tips that make hand firing
your plant at peak efficiency

By W. C. Lammey



"SPREADING" METHOD OF FIRING
NOT RECOMMENDED



NO ONE would deliberately throw a shovel or two of coal outside every day, yet the equivalent of this waste is discharged into the air in the form of combustible gases by many home heating plants. A smoky fire consumes fuel but produces insufficient heat, which is one of the most common complaints of home owners. The causes of this trouble are many and varied, and are best found by the process of elimination—starting with the most likely cause, which is incorrect firing, and then proceeding with other causes until the trouble is found and corrected.

Keep the ash pit clean: It should always be nearly empty. Ashes banked up in the pit as indicated by A in Fig. 1, reduce air supply, increase the velocity of what air does reach the fire when the lower draft is open, and result in "live" and "dead" spots here and there over the fire bed. Ashes touching the grates at any point tend to concentrate the heat and warp or break the grates. It's best to clean the ash pit before shaking the grates. A thin, skimpy fire, B in Fig. 1, also Fig. 22, is wasteful of both heat and time as it requires more frequent attention. Fuel bed should be level with or slightly above the bottom of firing door.

Spreading method of firing causes slow "pickup": Spreading fresh fuel over the whole fire bed as in Fig. 2, "blankets" the fire, shuts off the heat, and results in the release of great quantities of valuable gases, which escape unburned up the chimney. In firing soft coal, a dense smoke is produced when a bed of live coals is covered with fresh fuel. Before ignition can take place over the whole fire bed the furnace and the house cool down. As a result, there is a tendency to force the fire with full draft, which speeds

with COAL

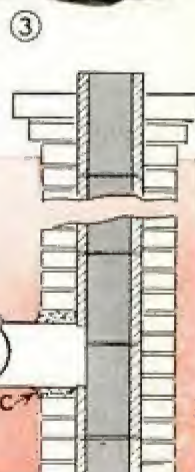
troubles in home heating plants.
easier and enable you to operate
and greatest economy

up the rate of ignition and makes the fire wasteful and difficult to control.

House cold in the morning: This condition can be due to many causes and to defects in the heating plant. The chart in Fig. 9 is the result of a study of reasons for the unsatisfactory operation of home heating plants. Banking the fire with ashes is one of the causes. Ash placed on live coal gradually stops the burning. The heat is absorbed by the ash which reaches the fusion point and forms a clinker. The latter slows down flow of air through the fuel bed. By morning the fire will be practically out. The remedy is to be sure the equipment is in good condition and then fire by approved methods, leaving a trifle more draft on the fire over night.

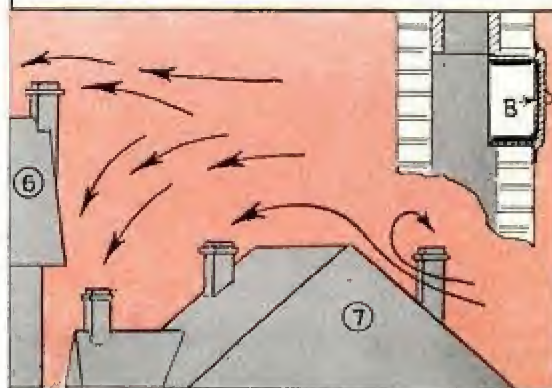
Fire picks up slowly or is sluggish: This condition usually is caused by a poor draft. Check the ash pit. Probe the fire bed for clinkers or a hard crust, which sometimes forms over the burned-out ash. Open the cleanout door and examine the interior of the furnace with a flashlight for heavy deposits of soot and fly ash which sometimes collect in sufficient amounts to hamper the draft. Be sure the turn-damper, A in Fig. 5, is open. If correcting these conditions fails to remedy the trouble, then use a strip of tin as a feeler gauge and "feel" along the edges of all doors, as in Fig. 3. Check fire doors, clean-outs on furnace and at the bottom of chimney as at B in Fig. 5. If you can insert the "feeler" and move it a distance of more than 3 or 4 in. along any of these openings, you have an air leak that may interfere with the draft. This can be corrected by filing the edge of the door until it fits.

Chimney or surrounding structures reduce draft: A large tree near the house, Fig. 4, with its top higher than the chimney, can be the cause of impaired draft, as it creates an eddy air current, and sometimes a strong down-draft when the wind is blowing. Likewise, adjacent buildings higher than the chimney will cause the same condition as indicated in Fig. 6. If the top of the chimney is lower than the roof ridge you are almost sure to have trouble.



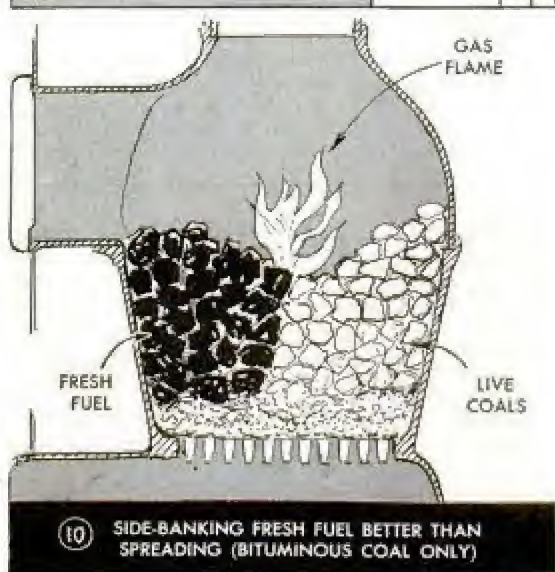
HOW TO FIND YOUR TROUBLE

When your heating plant operates unsatisfactorily there are usually many possible causes for one effect. Generally the causes of insufficient heat, poor draft, excessive consumption of fuel, clinker formation, etc., are easy to discover and remedy if one takes the time to apply a simple process of elimination. As an example, the cause of poor draft may not lie in the heating plant at all. In certain cases it has been found that simply opening the basement door or a window has completely cured the trouble. In these instances the remedy was simply more air circulation in the basement. Often, cures for other troubles are just as simple.





<p>⑨</p> <p>FAULTY EQUIPMENT 67%</p>	<p>IMPROPER FIRING, 23%</p> <p>IMPROPER SIZE COAL, 5½%</p> <p>OTHER CAUSES, 4½%</p>
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Air striking the roof is deflected as in Fig. 7 and the resulting eddy currents create down-drafts in the chimney. In severe winter weather, the cold air in the upper part of the flue of the outside chimney may act as a baffle, checking the free movement of gases from the chimney. The procedure in correcting any of these faults depends, of course, on the conditions. If there is no outside defect, then it's well to examine the chimney itself. Any large cracks in the mortar or at the smokepipe opening, C of Fig. 5, will act as check dampers. Finally, remember that nests of chimney swallows, or swifts, sometimes block the flue. Also, a basement or cellar that is shut up tightly is nearly always "air-locked." Records show that sometimes opening the basement door or a window slightly will cure a stubborn case of poor draft.

Fuel bed for mild weather: The entire grate area is not needed during mild weather so only the center is kept clear with the poker. The grates are not shaken and ash is allowed to bank up on the sides of the fire pot as in Fig. 8. This cuts down the heat output of the fire bed and, at the same time makes it easy to control. Due to adding smaller amounts of fresh fuel, such a fire will burn low in a shorter time, making it advisable to put on full draft a few minutes before firing so there will be a bright coke bed to receive the fresh fuel. Note in Fig. 8 that the live coals are pushed to one side before firing the fresh charge of coal. To hold the fire longer, cover the nut coal with a shovelful of fine slack as shown. This can be made by breaking up larger pieces of coal to the pea size. Be sure, before leaving the fire, that a gas flame has started, otherwise it will smolder. Also, there is the likelihood that the column of gases from a long-smoldering coal fire will ignite suddenly and cause a serious explosion. See that there is a fairly strong draft just after firing, especially on windless days. Once the gas is ignited, the drafts usually can be closed and the fire checked to conserve the heat.

"Side-banking" when firing soft coal: In any weather, side-banking the fresh fuel as in Fig. 10, is a great improvement over the spreading method in that it prevents rapid escape of gases which takes place when fresh fuel is spread over a hot bed of coals. Grates are shaken lightly to remove surplus ash, live coals are worked to the back or side of the fire pot, and fresh coal is placed in the pit or depression thus formed. The charge is not heaped but live coals and fresh fuel are sloped to the center as indicated. By this method ignition of the fresh fuel takes place slowly and the gases are burned as they are driven off. It is essential to remove all live coals from

the bottom of the depression where the fresh fuel is placed, as otherwise ignition will take place from the bottom as well as the side and the value of the practice will be lost.

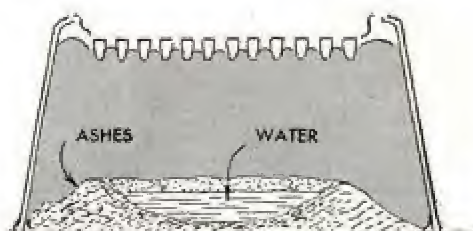
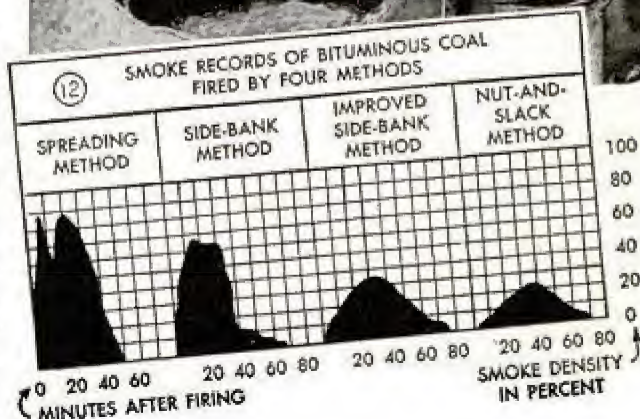
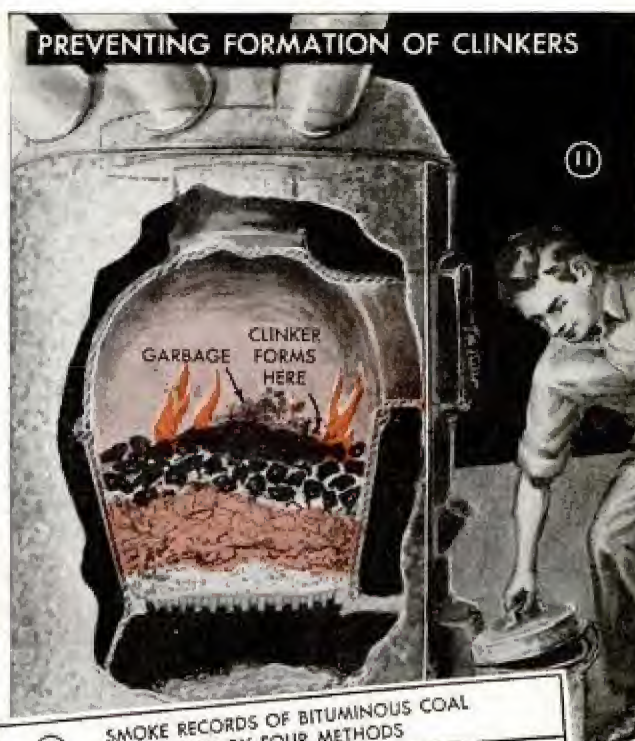
Don't burn garbage in furnace: Garbage thrown on a hot fire, Fig. 11, will immediately cut the heat output by as much as 50 percent, and it will take the fire some time to recover even a part of the loss. Even a small quantity of garbage or other foreign material is almost sure to form a hard clinker when thrown on a hot fire. In addition to the heat loss and consequent waste of fuel, a large clinker is often very difficult to remove. Sometimes the furnace and grates are damaged in the process. A clinker forming in the hot fire also tends to blanket the heat and, in effect, force it downward, sometimes heating grates to the danger point.

Avoid closing drafts on a high fire: Closing the drafts suddenly on a very hot fire often causes a hard clinker to form as the furnace surfaces cannot absorb the excessive heat that is suddenly bottled up and reflected back into the fire bed which quickly fuses or makes clinkers under the excessively high temperature. It's better to close the drafts on a hot fire by stages, leaving the lower draft open just the width of a match stick, and opening the check damper only part way until the burning rate slows down to more nearly normal.

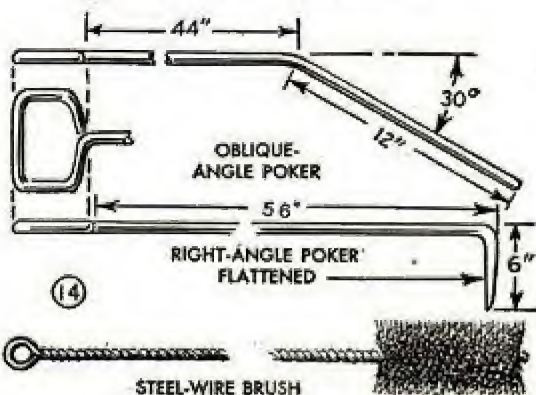
Water in ash pit aids combustion: With certain grades of fuel, clinkering can be prevented and combustion aided considerably by leaving a small quantity of ash in the ash pit and keeping this moist by adding water occasionally, as in Fig. 13. In this connection it's also a good idea to wet or "temper" the fuel. This should not be done immediately before firing but the fuel should be sprayed at regular intervals with water so that the coal particles have a chance to absorb moisture.

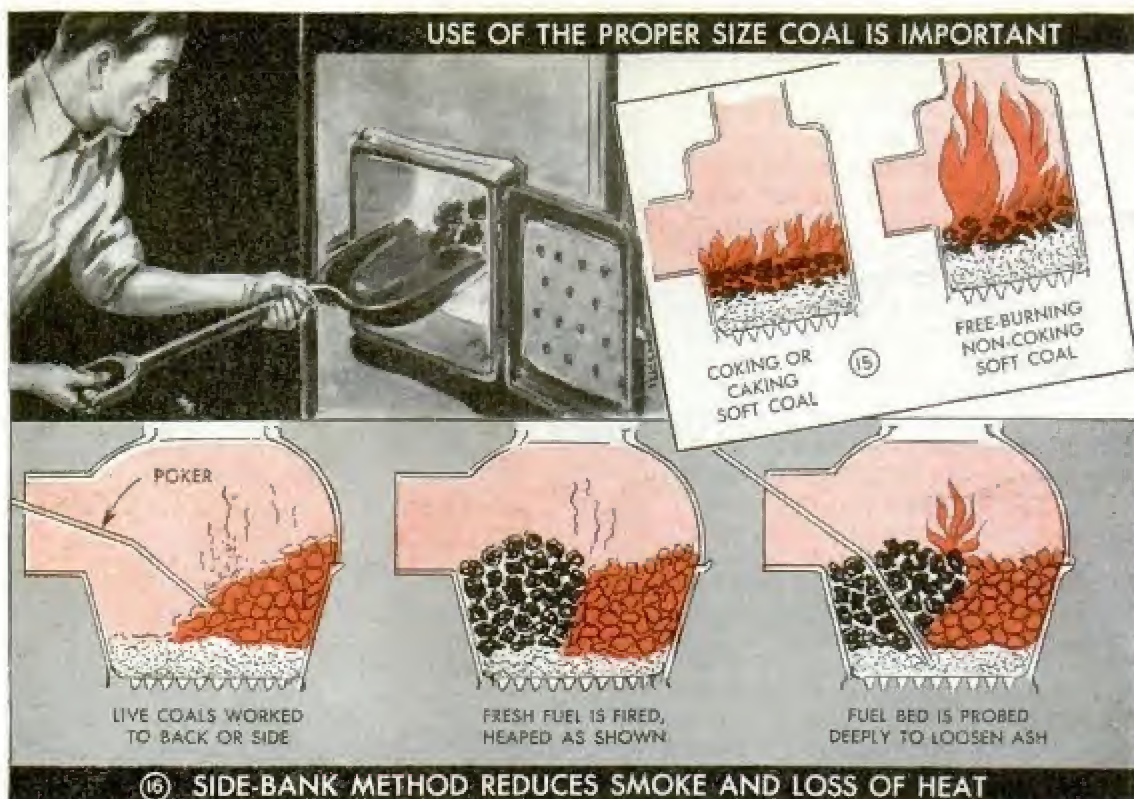
Tools needed in hand firing: In firing a furnace by any of the recommended methods you will need two pokers and the wire cleanout brush shown in Fig. 14. Of the two pokers the oblique-angled type is the more important as it is efficient in probing the fire bed and in working live coals to the side of the fire pot. The wire flue brush is essential for loosening soot and fly ash.

Use the right size coal: Usually this is more important when burning the smokeless fuels, such as hard coal and coke, but it also applies in the extremes to soft fuels.



(13) WATER IN ASHPIT AIDS BURNING





17 LARGE LUMP FUEL RESULTS IN EXCESSIVE HEAT LOSS



18 SMALLER LUMP SIZES ADMIT LESS AIR, BURN MORE EFFICIENTLY; APPLIES TO ANTHRACITE COAL AND COKE

As an example, fine soft-coal slack and forkings cannot usually be burned successfully in the average home furnace without a forced draft. When firing soft coals by any of the three approved methods the sizes generally referred to as nut, stove and range, usually will be found satisfactory. Most soft fuels are divided into two types known as coking or caking coals and the free-burning non-coking type, Fig. 15. These terms refer to the burning characteristics rather than to the lump size. Also, the two are sometimes referred to as short and long-blaze coals. In the hard fuels, particularly coke, the large lumps bulk up loosely admitting the passage of excess air through the fire bed. This condition moves the heat so rapidly that only a part of it is absorbed and transferred by the exposed surfaces of the furnace, Fig. 17. Loss of heat up the chimney is sometimes excessive. The smaller lump sizes, Fig. 18, admit less air, burn more efficiently in a deep fire, Fig. 23, and produce more useable heat. Where the natural draft is very strong the burning rate can be controlled better if a small amount of fine lump fuel is placed on top of the regular charge.

Improved side-bank method: With two exceptions in procedure, this is the same as the ordinary side-bank method. The sequence of the firing operations is detailed in Fig. 16. By this method the grates are rarely, if ever, shaken. The fresh fuel is heaped slightly as indicated and as the final step the fuel bed is deeply probed over the whole grate area to loosen and sift out the fine ash.

Nut-and-slack method: This method of firing is essentially the same as the side-banking procedure except that two sizes of coal are used. Fig. 21 de-

19 KEEP THE BOILER OR FURNACE CLEAN

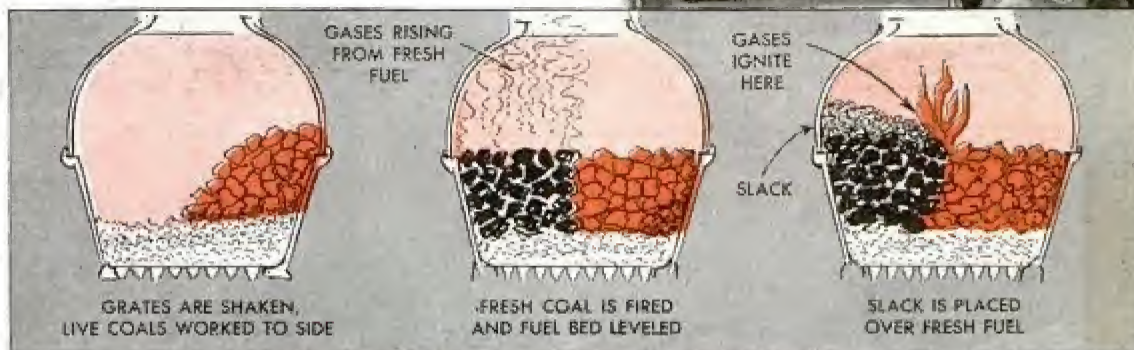
HEAT LOSS FROM
FLY ASH AND SOOT
IN TERMS OF COAL



$\frac{1}{32}$ " DEPOSIT
9.5% LOSS
190 LBS.
OF COAL

$\frac{1}{16}$ " DEPOSIT
26% LOSS
250 LBS.
OF COAL

$\frac{1}{8}$ " DEPOSIT
45% LOSS
906 LBS. IN EACH
TON OF COAL



21 NUT-AND-SLACK METHOD IS THE MOST ECONOMICAL OF ALL

tails the steps. Grates are shaken gently, with only a few long strokes as in Fig. 25. Coals and coke remaining from the previous charge are worked to the side of the fire pot. After firing the fresh charge, the fuel bed is leveled and slack is placed over the fresh fuel. Slack from the same kind of coal should be used if possible. Following the sequence of this method requires somewhat more coal for each fresh charge but actually the overall consumption of fuel is less than that when using other methods because of the greater heat output from a given amount of coal, assuming that the heating plant is in good condition. In addition, the latter method as described produces less smoke than any other as you can see from the smoke chart, Fig. 12. It's important to note that success with any of the three approved methods depends on careful attention to details.

Heat loss from fly ash and soot: Fig. 19 illustrates this loss graphically. One of the essentials to satisfactory operation is that the furnace and flue be kept clean, Fig. 20. On some of the later type hot-water and steam plants, passageways in the furnace can often be cleaned more efficiently by compressed air. Periodically scrubbing the radiator dome and the upper part of the fire pot with a wire flue brush usually will suffice for the average warm-air plant. Three other methods of ridding the furnace of soot as approved by the U. S. Bureau of Mines and the Engineering College, University of Illinois, are shown in Figs. 26, 27 and 28. Common granulated rock salt placed on a bright fire at regular intervals is quite effective. The methods shown in Figs. 27 and 28 also are effective in cleaning the flue but it should be remembered that on wood-shingled buildings there is some danger of a roof fire so it's



22 SHALLOW FIRE WASTES FUEL AND HEAT



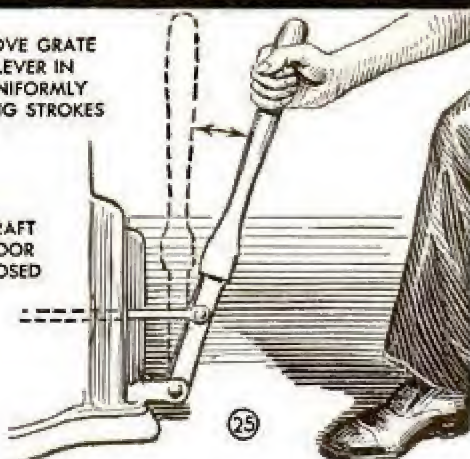
23 DEEP FIRE BURNS SLOWLY, CONSERVES HEAT AND COAL. APPLIES TO HARD AND SOFT FUELS



ALWAYS SHAKE GRATES GENTLY

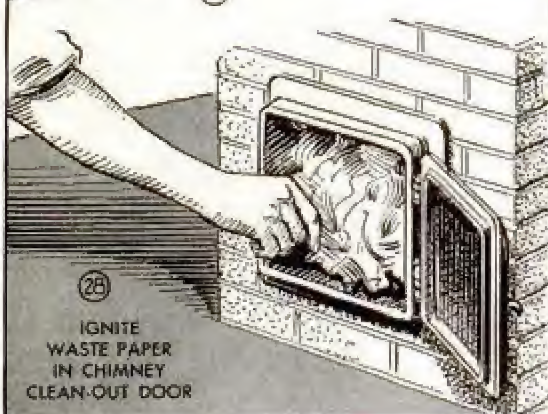
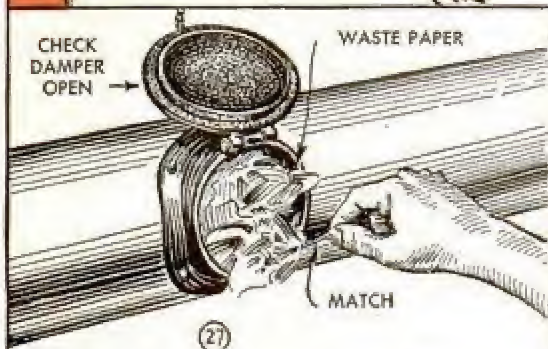
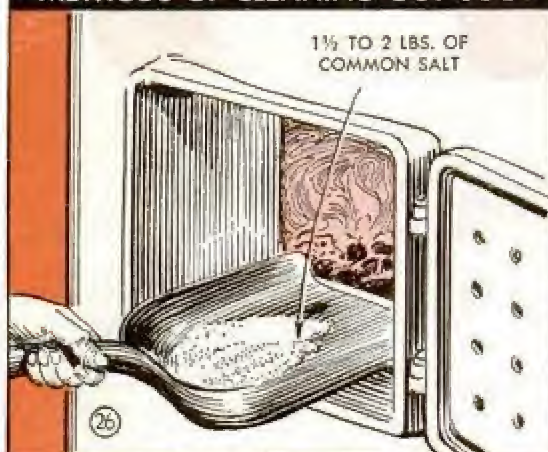
MOVE GRATE
LEVER IN
UNIFORMLY
LONG STROKES

DRAFT
DOOR
CLOSED



METHODS OF CLEANING OUT SOOT

1½ TO 2 LBS. OF
COMMON SALT

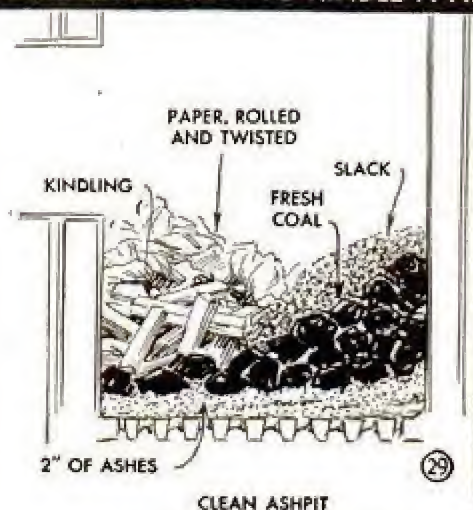


a good idea to burn out the flue only on damp or rainy days when the roof is wet. It should never be done in a chimney in poor condition or where the soot accumulation is unusually heavy. Clean out the bulk of the soot by other methods, such as dragging a chain up and down in the flue.

Over-draft damper: When burning soft coal the use of the over-draft damper, Fig. 24, in the fire door is important as gases evolved from the fresh fuel will not ignite in the furnace unless mixed with air. Just how much the over-draft should be opened depends somewhat on the fuel and the peculiarities of the individual furnace.

Kindling the fire: Ordinarily, paper is first placed in the furnace, the kindling next, and finally a small quantity of coal. A better method reverses this procedure as in Fig. 29. First, ash is worked through the grates until only about a 2-in. layer remains. Then the coal is placed as shown, with slack on top, leaving a depression at the front near the fire door. Into this is placed the kindling with rolled and twisted waste paper on top, which is lighted.

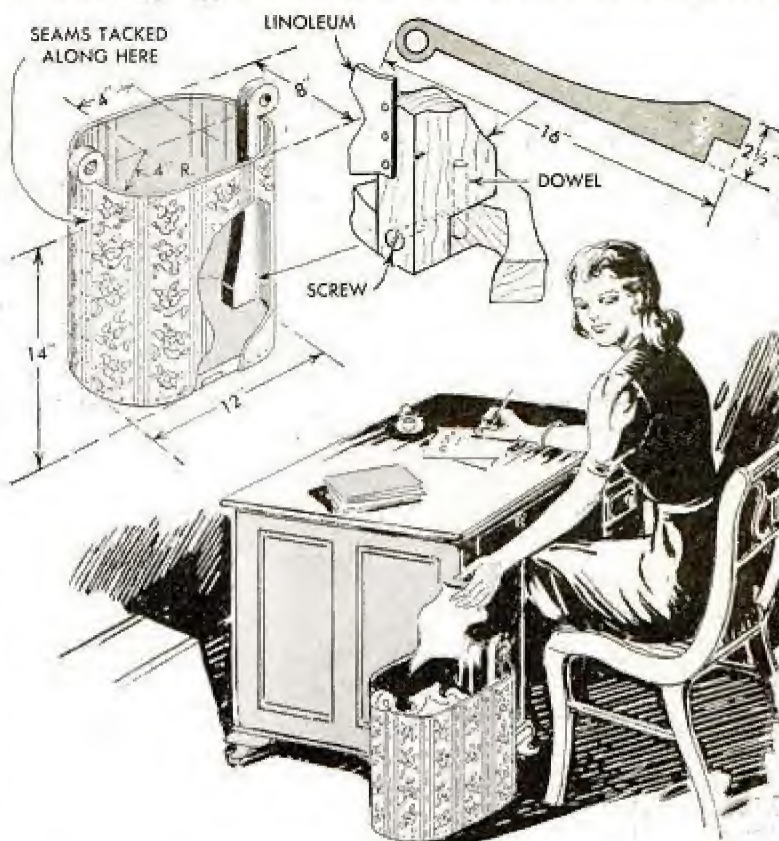
THE RIGHT WAY TO KINDLE A FIRE



CLEAN ASHPIT

Gaily Colored Wastepaper Basket of Linoleum

Strong and attractive wastepaper baskets of colorful linoleum to match or complement the decorative scheme of any room can be made in various sizes. All you have to do is band- or scroll-saw an oval or circular bottom from a piece of $\frac{1}{2}$ or $\frac{3}{4}$ -in. wood and attach to this two vertical pieces as shown in the details. Note how screws and dowels provide rigidity at the joints, and that the rounded upper ends of the pieces are bored to form finger holes to facilitate carrying the basket. Before attaching the linoleum, lay it in the sun or in a heated room until it is warmed thoroughly so that it will not crack when shaped around the basket bottom. Apply the linoleum so that the seam comes directly over one of the vertical pieces.

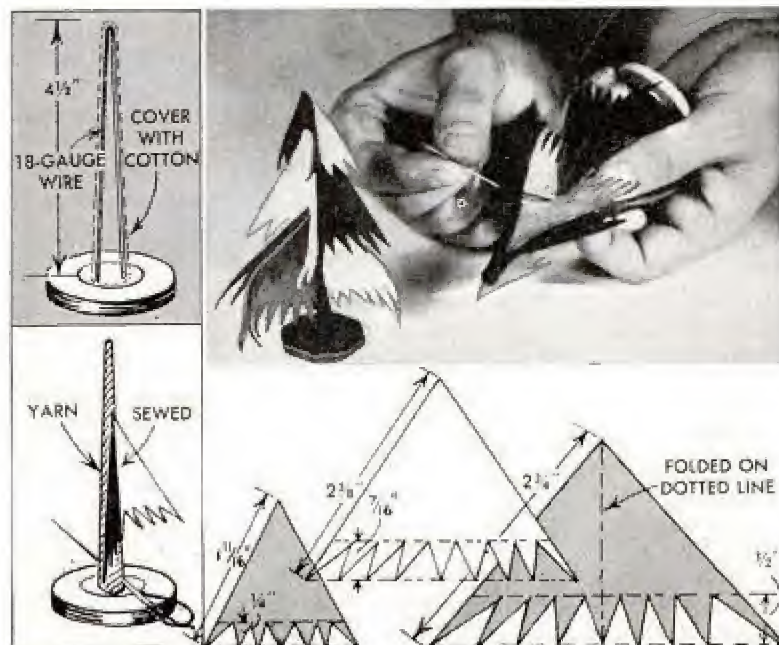


Miniature Christmas Trees That Provide Ideal Yule Favors

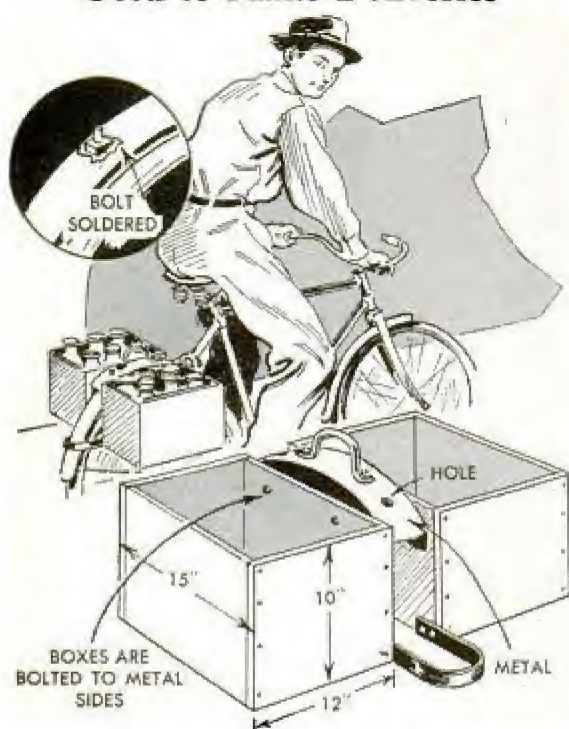
These novel little trees make ideal decorations for the yule season, and also are appropriate for favors or placecard holders at parties. The base of each tree is a wooden button, and the trunk is a 9-in. length

of wire bent in the center and the ends inserted into the holes of the button. Yarn or cotton cloth is wrapped around the trunk for attaching the branches, which are

sewed to it. These are triangular pieces of thin felt, leather, heavy fabric or tinfoil, which are creased in the center so that each piece provides two branches when fastened to the tree at the crease. Use two colors that contrast, and make the branches in three sizes as indicated, attaching the largest ones at the bottom of the tree and the smaller ones toward the top to produce the desired cone shape.—M. H. Lemberger, Chicago.



Saddle Boxes Improve a Bicycle Used to Make Deliveries



In order to make the package boxes on his bicycle removable so that they could be carried into homes when making deliveries for a store, one boy built them into a unit that rests astraddle the rear wheel. A piece of heavy sheet metal was shaped to the contour of the bicycle rear fender, and short side pieces were soldered to it, after which the boxes were bolted to these. Then, a carrying handle was fitted to the unit, and holes were drilled near the ends of the fender-shaped piece to fit over short stub bolts welded or soldered to the top surface of the bicycle fender. A U-shaped metal strip keeps the boxes spaced apart at the bottom. The entire unit is lifted from the bike and carried into the home when making a delivery.

Crayon Outlines on Novelties Better Than Painted Ones

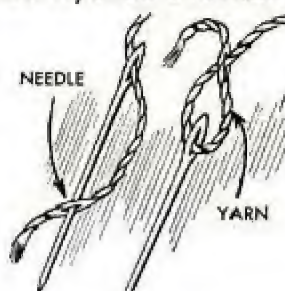


Outlines made on painted novelties with wax crayons or pencils are easy to apply and are more effective on some designs. On animal figures, for example, the crayon lines give a softer, more fur-like texture. Be-

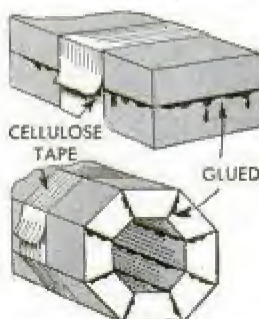
sides the advantage of a more realistic appearance, the lines can be removed easily if a mistake is made when drawing them. For lasting results, crayon lines should be covered with a coat of clear white shellac to prevent smudging.

Keeping Yarn in Eye of Needle

The annoyance of having yarn pull from the eye of a needle and cause frequent re-threading may be avoided by first pulling the yarn through the eye and then spreading the strands near the end that was pulled through and inserting the needle as indicated. This will make a smooth tie without a knot.



Cellulose Tape Used as Clamp For Small Gluing Jobs

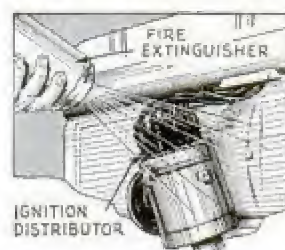


On model work and other jobs where it is necessary to glue tiny parts together, cellulose tape provides a quick and effective gluing clamp. Small parts of almost any size and shape can be clamped together,

and the tape is removed easily without damage to the work when the glue is dry. Each wrapping should consist of three layers, and the finish end should be left free so that the tape can be stripped off easily.

Car Ignition Dried Chemically

It is a good idea to keep a small bottle of carbon tetrachloride in your car at all times. Then if the ignition system becomes so wet that the motor will not start, you can use the chemical to dry the system quickly. To do this, just spray or sprinkle the chemical over the wet parts and then apply air with your tire pump. This will remove the moisture rapidly. Carbon tetrachloride is available in most drug stores in the form of a liquid clothing cleaner. Also, in many of the small fire extinguishers.





SHOP NOTES

Quick-Change DRILL TABLES

By Sam Brown

MOST craftsmen appreciate the merits of a good-size auxiliary wood table for all operations in wood-working on a drill press, but often forgo this convenience because of the time and trouble required in attaching and detaching such a table. This nuisance is eliminated in this set of three tables, which will enable you to perform more easily every wood-working operation possible on a drill press. All three tables feature the same simple quick-change mounting that permits switching from one table



Table No. 1 — THIS STYLE WITH ADJUSTABLE FENCE IS USEFUL FOR DRILLING AND STRAIGHT-LINE ROUTING JOBS

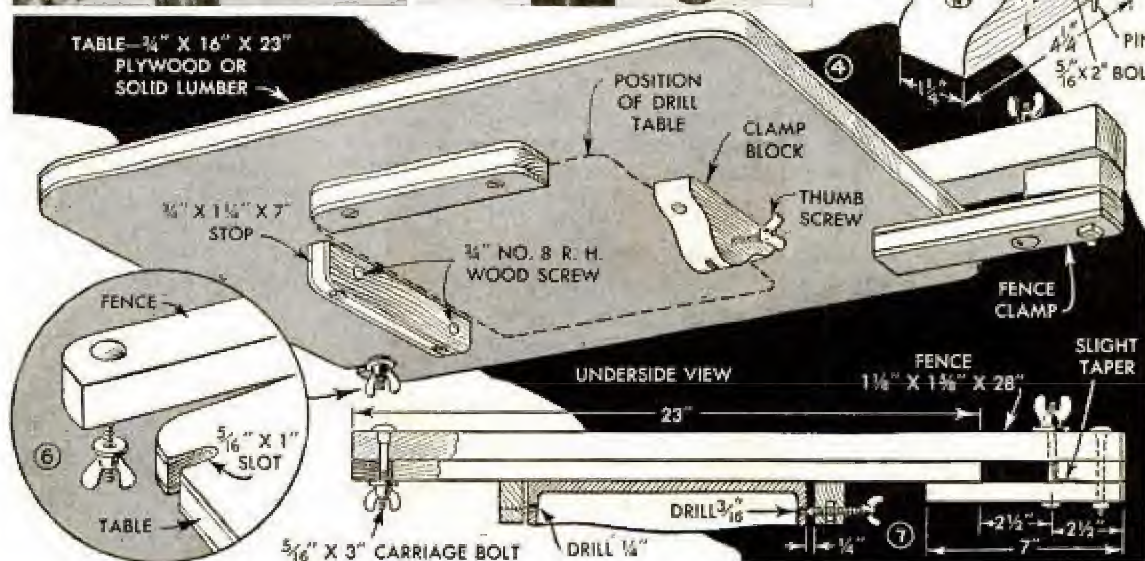
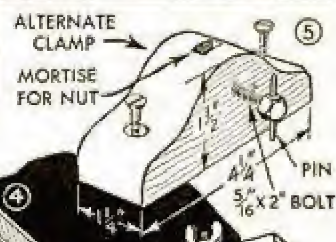
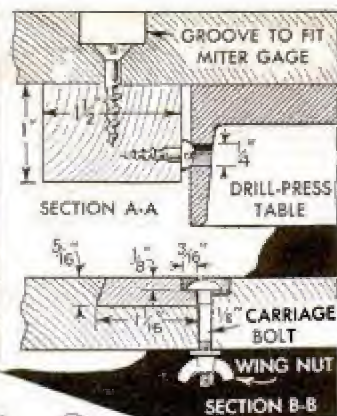




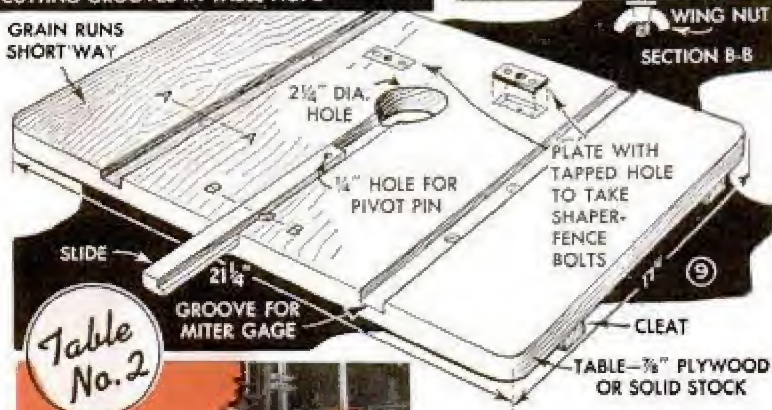
TABLE NO. 1 IS USED WHEN CUTTING GROOVES IN TABLE NO. 2



to another in a matter of seconds.

As indicated in the details, the mounting consists of three wooden blocks, a pointed thumb screw and two round-head wood screws arranged as shown in Fig. 4. The screw heads fit into holes drilled through the side of the drill-press table, and the thumb screw clamps the other side. The left side of the drill table has two $\frac{1}{4}$ -in. holes spaced about 5 in. apart and $\frac{3}{4}$ in. down from the top as shown in Fig. 2. The right side of the table has one $\frac{3}{16}$ -in. hole located about 1 in. from the top. It may be necessary to off-center this hole slightly in order to avoid running into ribs on the underside of the table. All three holes are drilled entirely through the metal to permit easy marking of the screw positions on the clamp blocks of the auxiliary table. The blocks should be checked carefully to see that the screw heads engage exactly in the holes when the block top is level with the drill table, Fig. 3. Note the $\frac{1}{4}$ -in. clearance between the thumb-screw clamp block and the side of the drill table as indicated in Fig. 7. The hole for the thumb screw is threaded with an ordinary tap, or you can use a nut fitted in a mortised hole, as shown in Fig. 5.

Table No. 1, which is pictured in Fig. 1, is the



SANDING OR SHAPING CIRCULAR WORK



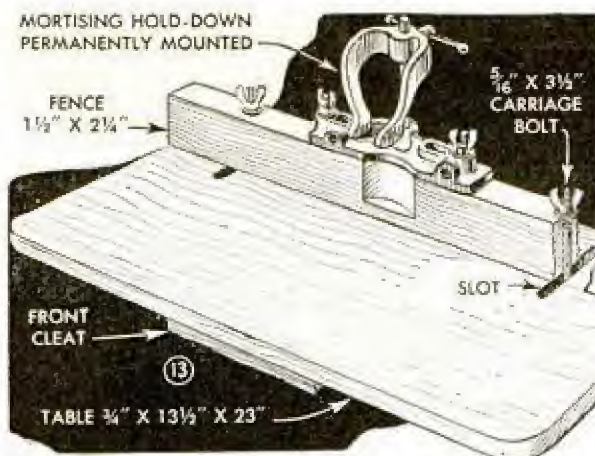
SHAPING WITH REGULAR SHAPER FENCE



FOR CROSS ROUTING OR SHAPING

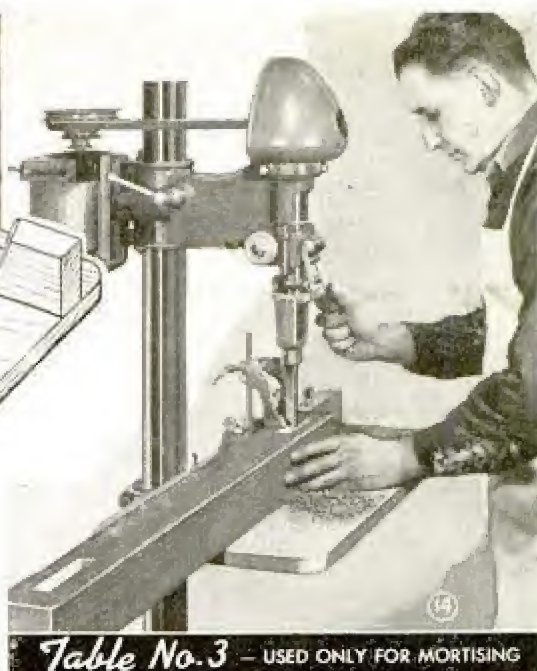
"work horse" of the three tables, being used for all drilling and straight-routing operations. Although the table itself is wood, a base block should always be used when drilling so that the table will have as long a life as possible. The table should measure about 16 by 23 in. The preferable stock is $\frac{3}{4}$ -in. five-ply plywood or lumber-core plywood, but if plywood is not available, a very good table can be made by glue-jointing solid lumber. The fence on this table is pivoted at one end as in Fig. 6, and is fitted with a clamp at the other end so it can be shifted to any desired position, or be removed entirely as needed.

Incorporating set-ups needed for several different jobs, table No. 2 is quite versatile as indicated by the typical operations pictured in Figs. 10, 11 and 12. It is practical to fit this table with a fence like the one on table No. 1 so that various routing jobs that require a fence can be done. The



pivot slide has a $\frac{1}{4}$ -in. hole at the inner end to take pointed or stub metal pivot pins. Fig. 9 shows the general construction. The table is made with the wood grain running the short way. The front locating cleat should run clear across in order to eliminate warping, and the clamp cleats on either side should be made a little heavier and a little longer in order to stiffen the thin section under the miter-gauge grooves. Dimensions of the table can be varied slightly to suit wood on hand, but it should be noted that this table requires depth for cross-routing and circular work. As indicated in Fig. 8, table No. 1 is handy when cutting the grooves in this table.

Table No. 3 is a single-purpose one used only for mortising as in Fig. 14. Its con-



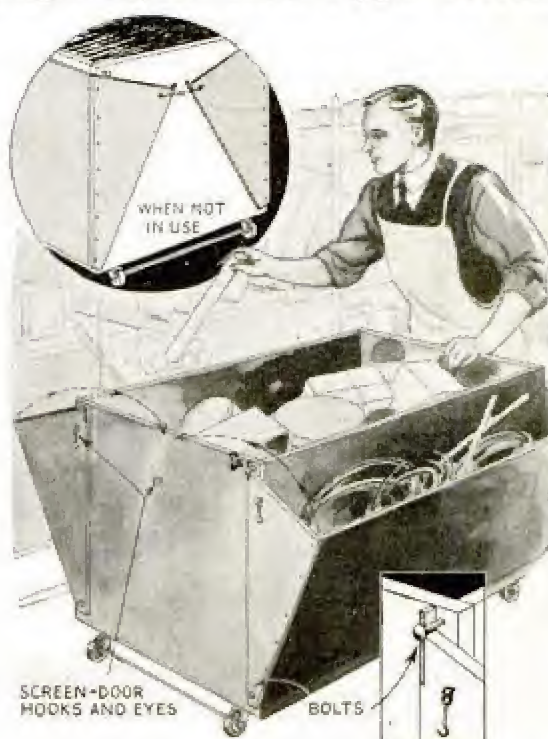
struction is very simple as indicated in Fig. 13, requiring only a plain wooden table with slots to permit the necessary adjustment of the fence. The table is practical in as narrow a width as 10 in., as most mortising jobs do not take up a great deal of front-table space. The wood fence and mortising attachment are mounted permanently, thereby reducing the total set-up time required for mortising work.

Folding Wing Bins Increase Capacity of Box-Type Truck

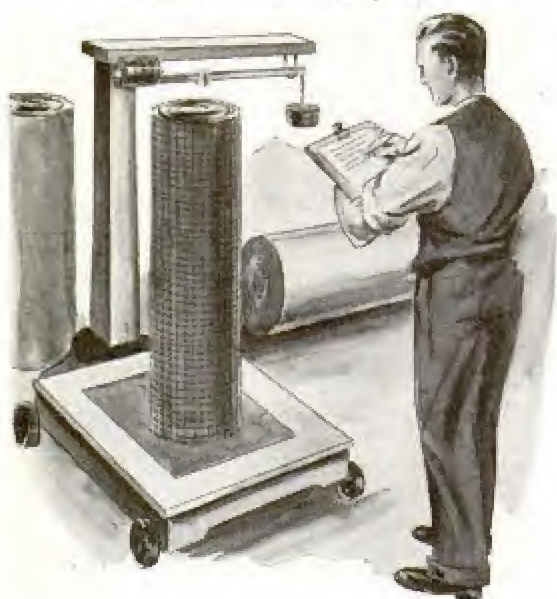
Ideal for carrying brooms, rakes, odd-shaped items and other articles that ordinarily would prevent packing a full load on a box-type store or warehouse truck, these pivoted side bins also permit segregating fragile goods from nonbreakable items when hauled in the same truck load. The bins are pivoted to the sides of the truck body near the bottom. Bolts or large screws at the top of the truck ends serve as stops to keep the bins in the opened position, and screen-door hooks and eyes keep them in the folded position. Stock $\frac{3}{4}$ in. thick is used for the end pieces and tempered, hard-pressed board for the sides.

EVERYBODY IS AN INVENTOR

Nearly everybody has discovered some kink or shortcut to solve one of those seemingly trivial problems encountered in every home or in a person's work, hobby and play. But the solution may have saved time, money and energy. We pay readers for such ideas. Just submit a sketch or photo and a brief description to our Homecraft Editor. If acceptable for publication, we will send you a check promptly.



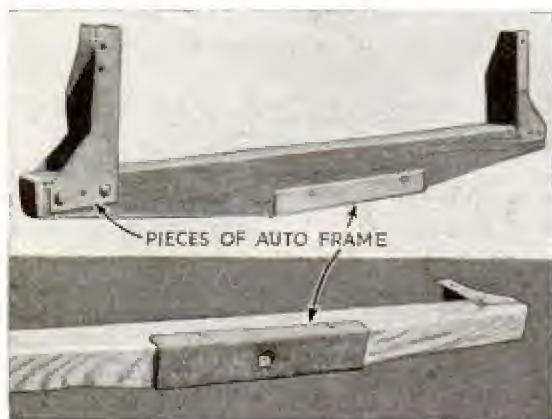
Screen-Wire Inventory Simplified By Weighing Rolls



Time required to take inventory where small quantities of screen wire and similar material are sold can be reduced considerably by weighing each roll when it is received. Then, at inventory time the rolls are again weighed to determine the amount of material in each one, which is done easily as follows: For example, a new roll of screen wire, which weighs 60 lbs., and contains 100 yards of wire, weighs 12 lbs. at inventory time. The amount of wire on hand in yards is obtained by simply multiplying 100, the original yardage, by 12, the present weight, and dividing the result by 60, the original weight, which gives 20 yds., the amount still remaining in the roll.

Long-Wearing Bolster Fittings Cut From Old Auto Frame

Next time you have to replace a bolster on your farm wagon trucks, fit it with sections cut from an old auto frame to provide



long-wearing stakes and steel bottom plate. These are drilled and bolted in place as indicated, after the edges of all pieces are rounded slightly to remove any sharp pieces of metal which might cut the fingers in handling. When drilling holes through the bolster to attach the stakes, make two sets of holes for quick adjustment, if the trucks are used with a grain box and hay rack that are not the same width.

Counting Gear Teeth Accurately

Usually when it is necessary to count the teeth of a gear, one tooth is marked and the count made from it, but before all the teeth have been counted the workman forgets whether or not the marked tooth was counted.



A better way is to make a mark between two teeth as indicated, and start the count from an adjoining tooth, leaving no doubt as to whether or not the marked tooth was counted.

Drawer in Carpenter's Tool Box Handy for Small Parts



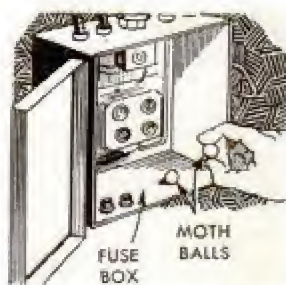
A tool box used by a carpenter or mechanic for carrying a few tools about on a job is greatly improved by adding a shallow partitioned drawer in the bottom for segregating small parts from the tools. An

opening is made in one side of the box to receive the drawer, and an extra floor or bottom is provided above the drawer.

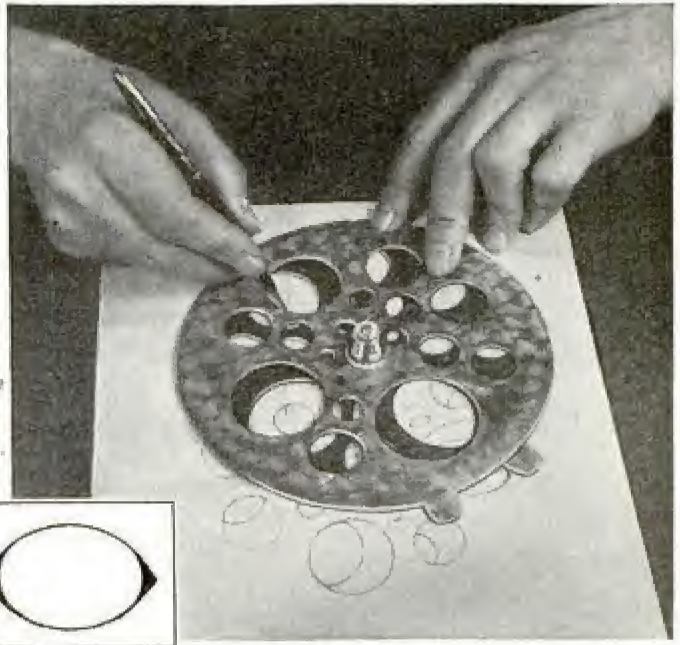
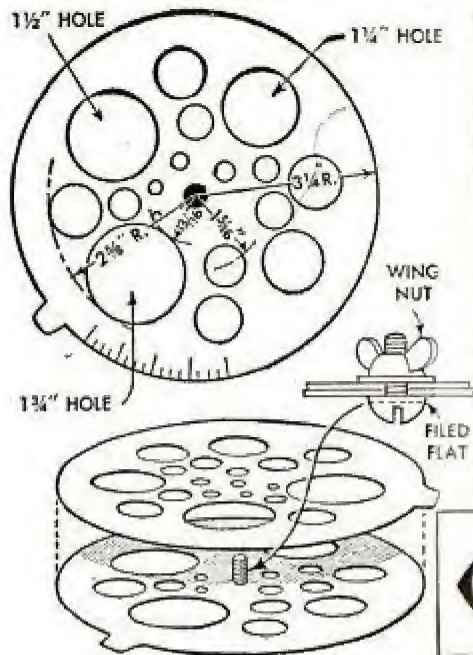
Wasps Prevented From Nesting In Switch Boxes

Switch boxes in barns and other outbuildings often attract wasps which build their nests inside them. To avoid this, one farmer keeps a couple of moth balls inside the box at all times.

As wasps dislike the odor, they will not enter the box under any circumstances.



Twin Templates Speed Drawing of Small Ellipses



Draftsmen will find this adjustable template a timesaver when it comes to drawing small ellipses, because after adjusting it for size, it is merely a matter of tracing around inside the opening and then completing the ellipse by rounding the ends freehand as indicated in the inset. The size and shape of the ellipses which can be drawn are practically limitless, as the slightest rotation of the top disk changes the shape of all the openings. The template consists of two metal disks, drilled identically according to the drawing above, and held together with a bolt through the center. Both metal

pieces are bored at the same time while sandwiched between two flat pieces of wood bolted together at the corners. Then the holes, which range from $\frac{1}{8}$ to $1\frac{3}{4}$ in. in dia., are located on concentric circles drawn on the wood for drilling. For the holes up to $\frac{1}{2}$ in. in dia., twist drills can be used, while several old wood bits, if used in a drill press, will do to cut the others. The large holes can be cut with a washer cutter. A small stove bolt with the head filed flat and fitted with a washer and wing nut locks the two disks together.

—R. F. Sprague, Joliet, Ill.

Automobile Wrist Pins Serve as Substitute for Gage Blocks

With precision gage blocks difficult to obtain, inexpensive micrometer gage blocks may be improvised by using new auto wrist pins. These, which are selected for size to suit the particular diameter or thickness of work being machined, can be had in various diameters, and are usually precision ground to within 0.0002 of an inch. Where work to be turned, for example, is to have several different diameters, wrist pins of corresponding size are used, by which the micrometer can be set quickly in changing from one diameter to another.—Allen Fiske, Chicago.

ⒸWhen using a valve-grinding tool that has a vacuum cup to grip the valve, apply a little gasket cement to the edges of the cup so it will hold firmly. The cup can be removed by inserting a knife blade under it.



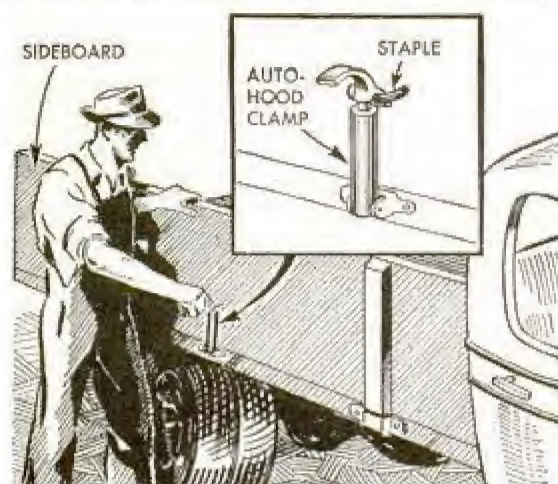
Blowtorch Fitted With a Shelf To Slide on Eave Gutter



Difficulty of holding a blowtorch safely and conveniently when working on eave gutters led one tinsmith to use a simple shelf like the one shown to support the torch on a gutter. It consists of a piece of sheet metal, the sides of which are bent up over the rim at the base of the torch, the ends of the sheet metal being bent downward to fit over the edges of the gutter. In this way, the shelf stays on the torch and can be lifted from or slid along the gutter.

Truck Sideboards Held Securely By Auto-Hood Clamps

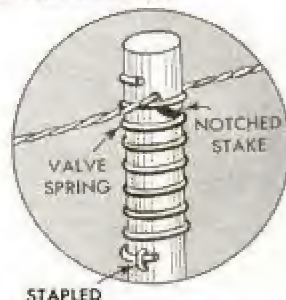
Loss of sideboards used occasionally on a flat-bed truck, was avoided by one owner who used auto-hood clamps to hold the sideboards in place. The clamps were fas-



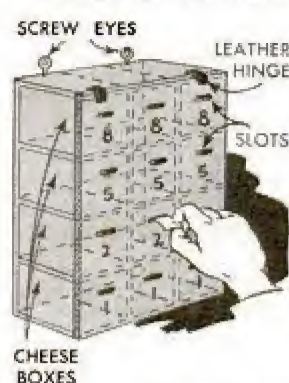
tened to the edges of the truck bed and large staples were driven into the sideboards to engage the hooks of the clamps. This arrangement prevented loss of the sideboards, yet made them easy to put on or take off the truck.

Springs Lock Excavator's Line On Notched Stakes

To keep his marking line stretched tightly, one excavator used old car valve springs and stakes that are notched near the tops as indicated. In use, the line first is stretched to encircle the stakes to which the springs are fastened as shown. Then one spring is compressed at a time and the line slipped into the notch in the stake, after which the spring is released to press against the line and hold it in place. This is done progressively until the line has been locked securely in all stakes.



File for Food Ration Stamps



In order to file food rationing stamps in order of their value as they are collected, one grocer uses a file cabinet made of empty cheese boxes. These are fastened together by either screws or nails, after which a front of heavy cardboard or thin wallboard is hinged to the top of the box assembly by means of leather hinges. Slots in the wallboard directly in front of the box ends offer a means of inserting the stamps.

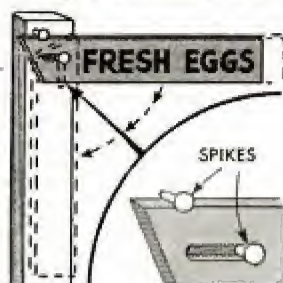
—J. D. Myers, Springfield, Ill.

Dead-Air Spaces Improve Lining Of Gas-Fired Blast Furnace

One workman found that an ideal heat-resistant lining for small blast furnaces of the gas-fired type could be made by mixing whole grain oats, 1 part, with asbestos flour of the type used on heating-plant boilers, 4 to 8 parts. This is moistened with water and worked until stiff enough to spread smoothly with a trowel or large

kitchen spoon. When about half dry, the gas is lighted and the air blast turned on to hasten the setting, increasing the heat until the lining is thoroughly dry. The oats eventually burn out completely, leaving small dead-air spaces in the lining, which greatly increase its insulating properties.

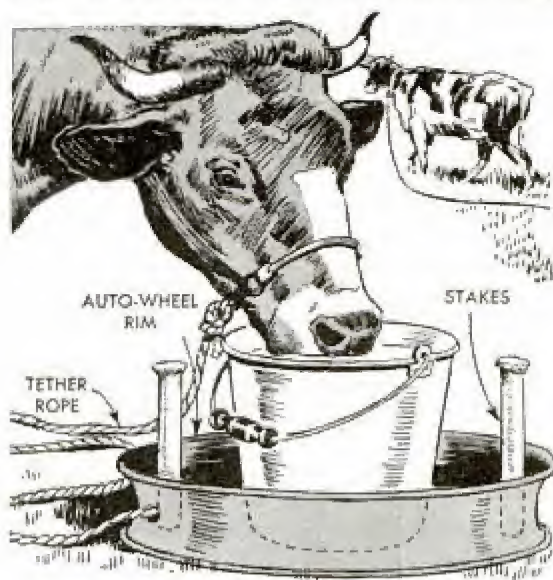
Sign Raised or Lowered Easily



Here is a simple roadside sign that can be raised when produce is available or lowered when it is sold out. Consisting of a board of suitable length, the sign is pivoted to a support by means of a nail which works in a slot. A second nail above and to one side of the first one holds the sign in a horizontal position when desired. Raising or lowering the sign is just a matter of moving it sideways to clear the nail or to slip under it.

Tied Animal Cannot Tangle Rope Or Spill Drinking Water

Keeping a tethered animal from upsetting its drinking water or tangling the rope on the anchor stake is a simple matter if you use an old auto-wheel rim as indicated. Tie the tether rope into the valve-stem hole in the rim, enlarging the hole if necessary. Then set the rim over two stakes as shown and place the water pail inside the rim. In this way, the pail will not be knocked over, and the animal cannot wind its rope around the anchor if the stakes are located to permit the rim to turn if the animal walks around the anchor while feeding.



DECEMBER, 1943

Save Time in Making Roof Truss By Using This Type of Form

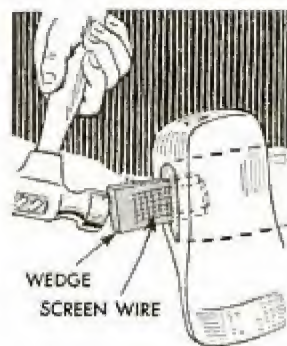


With this simple form you can save one-third to one-half the time usually required to construct roof trusses and be assured that all trusses will be exact duplicates, thus avoiding any sags or humps in the roof. To make the form, first make up a platform of boards or planks on a flat surface. Then assemble one half of a truss and nail it securely to the platform. Next, nail 2 by 4-in. blocks to the platform on each side of the heavier timbers of the truss, and nail 1 by 4-in. blocks on each side of the braces as indicated. These blocks now serve as a guide or form in laying the timbers and braces for all succeeding trusses. After completing one half of a truss, it is removed from the form and the other half is completed.

—Opie Read, Jr., Chicago.

Screen Wire Helps Hold Wedge Used to Anchor Ax on Handle

If the wooden wedge in an ax handle loosens easily, fold a strip of screen wire over it and drive it back into place. The wire provides rough sides for the wedge so that it will not work out of the ax handle.



131



ADJUSTABLE

How to Reset

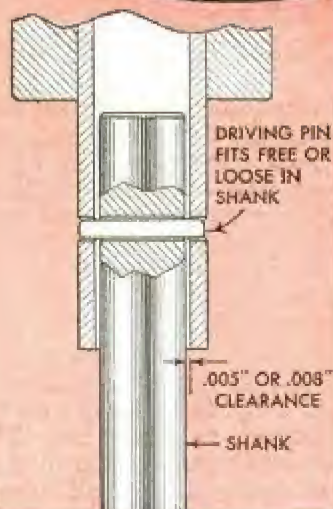
By H. J. Chamberland

REAMERS are end-cutting tools to finish holes within close limits. They are intended to remove only a slight amount of stock, usually from .006 to .012 in., from the sides of holes previously drilled or bored, presumably accurate, and in this respect reamers are radically different from drills, milling cutters and boring tools. Of the two general classifications of reamers—the solid type and the adjustable type—the former have no means of compensation for wear except by chromium-plating them, the cost of which is approximately

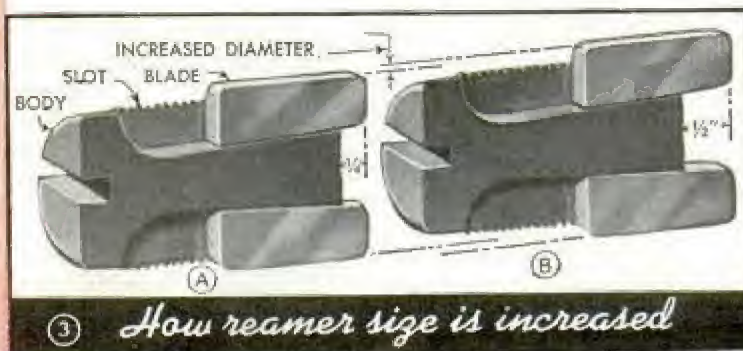
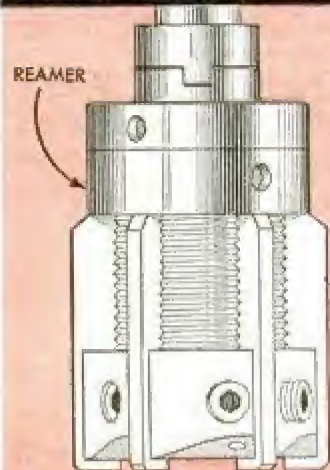
40 percent of the initial cost. On the other hand, adjustable reamers, which can be used over and over again between resettings and regrindings, represent considerable economy when compared to the solid type. Some types of adjustable reamers may be reset as often as fifty times.

Types of adjustable reamers: An adjustable reamer consists of a heat-treated steel body fitted with six or eight high-grade steel blades. Such reamers are available in different sizes up to 6 in. in diameter, a large one being shown in Fig. 1, in which case a Diesel-engine cylinder liner is being finished. Reamers of 1 $\frac{1}{16}$ -in. diameter and under have a shank and a body that is integral, but larger reamers are mostly of the shell variety, that is, they have a concentric hole permitting them to be fitted on arbors. When shell-type reamers are to be used in drill presses or radial drilling machines, they are fitted to taper-shank arbors, but for lathe use the reamers are fitted to straight-shank arbors. When reamers are used in multiples to align holes in machine castings, as in Fig. 14, they are mounted on a long, piloted arbor and have straight holes to permit spacing to requirements.

The method of adjusting reamers is based on the



The reamer "floats"



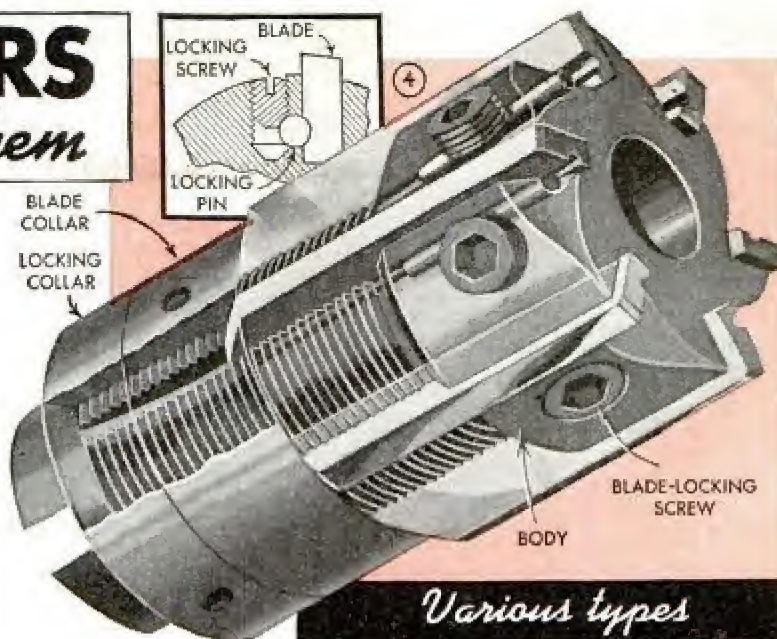
How reamer size is increased

REAMERS

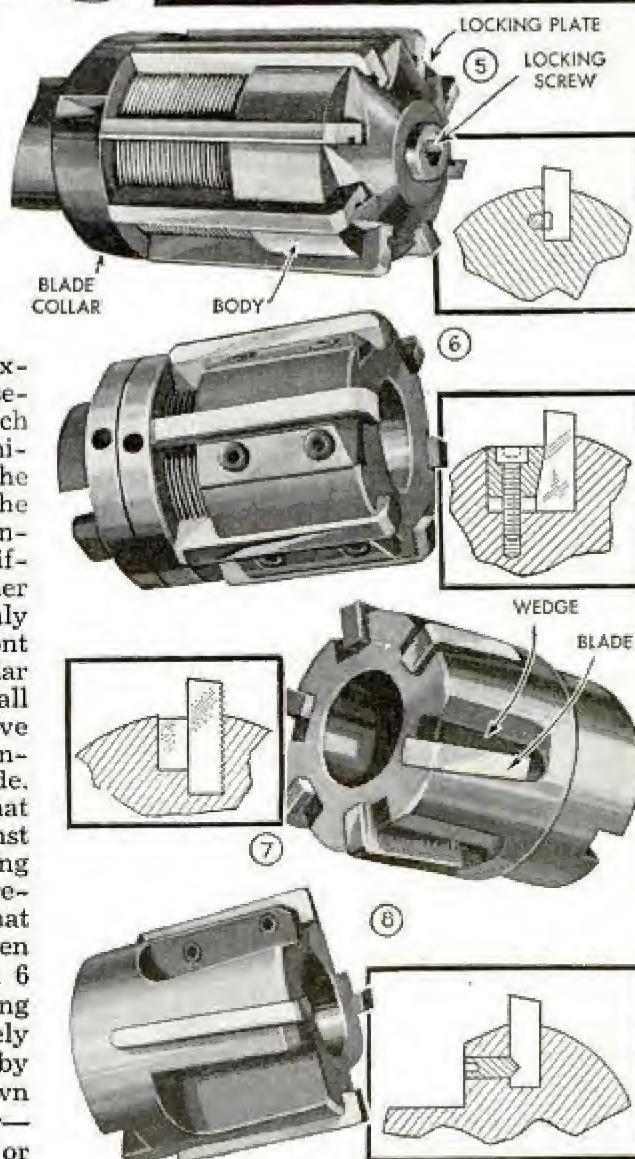
and Use Them

fact that the body of each reamer has tapering slots to receive the blades, which have a mating taper at their lower edge so that moving the blades in the slots will increase or decrease the cutting diameter of the tool. This standard principle is illustrated in Fig. 3, in which case the two opposite blades in detail A, projecting $\frac{1}{4}$ in. beyond the body, are moved so that they project $\frac{1}{2}$ in. beyond the body as shown in detail B, with the result that the diameter of the reamer is increased a certain amount. Although all adjustable reamers have this standard method of setting the blades to size, they differ in respect to the method of locking the blades. Tools required to reset the reamers are a spanner wrench and a socket wrench, in addition to a brass punch, hammer and mallet.

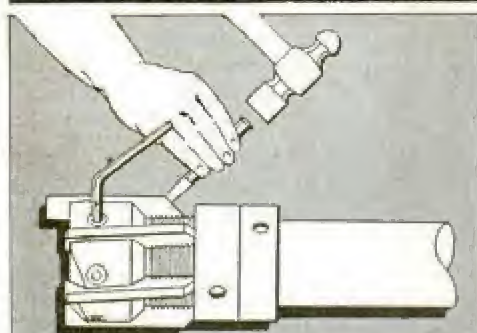
The reamer shown in Fig. 4 is a six-part tool, each blade being locked securely by means of a taper screw which presses against a pin that fits in a semi-circular groove milled parallel to the bottom of the blade, as indicated in the small detail on the left. Fig. 5 shows another style of collar reamer having a different blade-locking device. This reamer consists of seven parts, but it has only one collar instead of two, since a front locking plate replaces the locking collar shown in Fig. 4. As detailed in the small insert, a cylindrical pin engages a groove in the body and a rectangular pin engages a full-length groove in the blade. Both pins project from the body so that when the locking plate is pressed against these two parts by means of the locking screw, the desired wedging action results. The pin wedge is so designed that a $\frac{1}{4}$ -in. clearance is maintained between the body and the locking plate. Fig. 6 shows another six-part reamer having two collars. The blade is locked securely by means of a strap, which is wedged by two screws. Fig. 7 shows what is known as a serrated-teeth adjustable reamer—a three-part tool having no screws or



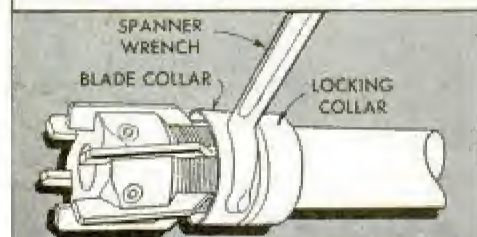
Various types



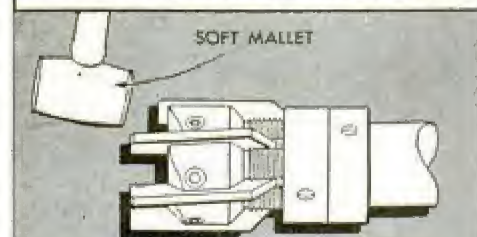
⑨ Step-by-step procedure in resetting the reamers



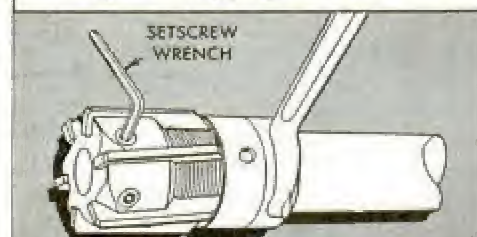
A Blades are unlocked and moved ahead with a brass punch and a hammer



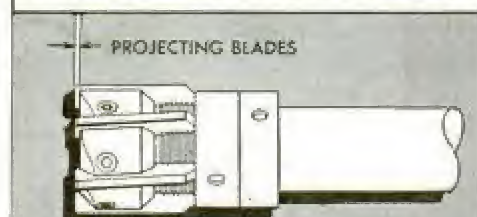
B Blade collar is turned to suit and the locking collar is turned against it



C Then blades are tapped gently so they butt snugly against blade collar



D After setscrews are driven down to tighten blades, lock collar is tightened



E Blades should not project beyond end of reamer more than $\frac{1}{2}$ their thickness

collars. Longitudinal serrations are milled in one side of each body slot and one side of each blade, resembling fine-cut threads on a flat surface. The other side of each slot is not serrated and takes the flat side of a wedge, which is serrated vertically on the other side to fit vertical serrations on the contacting side of the blade. The angular relation between one side of the wedge and one side of the slot gives the blade-locking action. In Fig. 8 is shown a three-part reamer, some designs of which have back-up screws to prevent blades from accidentally slipping back. A V-groove milled parallel with the bottom of the blade creates a positive lock by means of screws that are pointed to fit the groove.

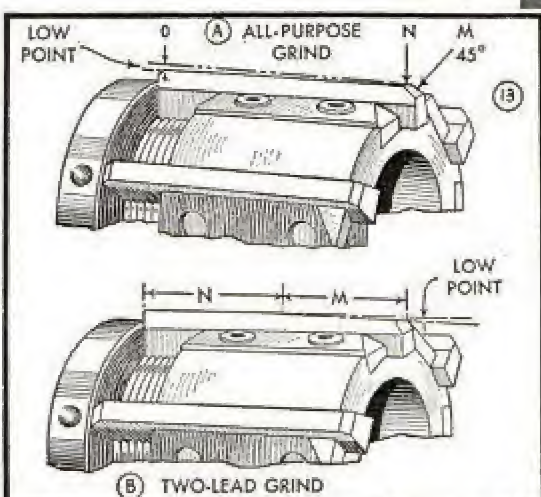
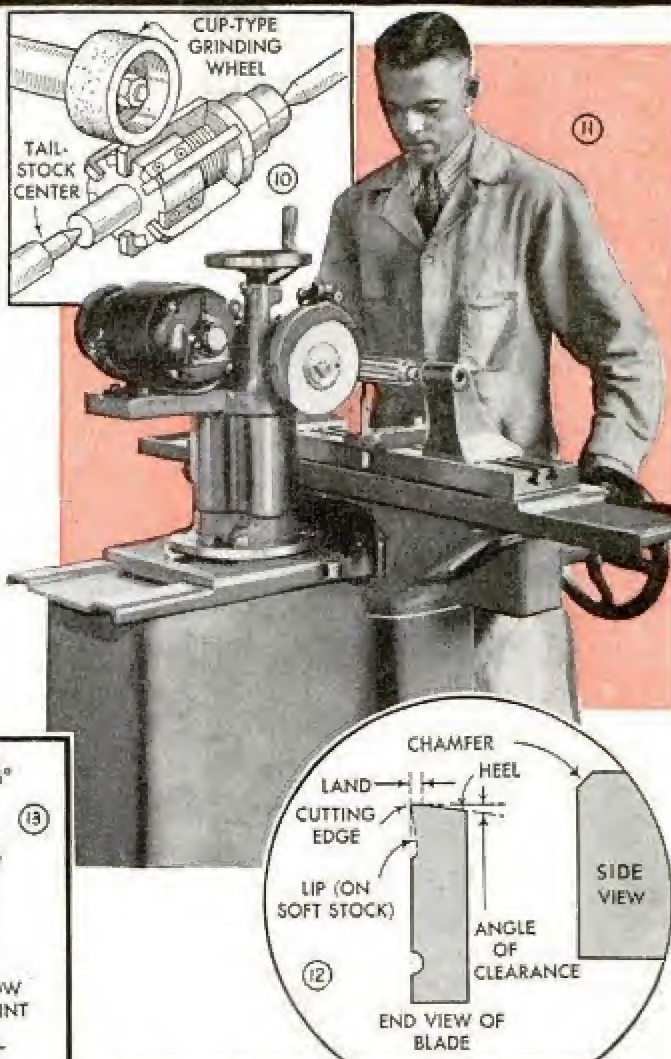
Setting adjustable reamers: The average 2-in. adjustable reamer has an enlarging range of 1 in. The procedure to reset reamers is very simple as is shown in Fig. 9. Detail A shows how the locking screws are loosened just enough to release the extreme tension of the blades, the reamer being held in a vise. Then the blades are moved ahead $\frac{3}{16}$ to $\frac{1}{4}$ in. with a brass punch and hammer. Detail B shows a spanner wrench being used to give the blade collar a one or one-and-a-half turn toward the blades; this generally increases the diameter from .005 to .008 in. Then the locking collar is set against the blade collar with the spanner wrench. Next, in detail C, the blades are pushed snugly against the blade collar, using a lead, brass or plastic mallet. Then all the setscrews are loosened about one turn, after which they are brought to maximum tightness by slight repeated take-ups as in detail D. After this, the locking collar is given another squeeze and all the blades are again tapped against the blade collar. Detail E shows that the end of the blades should not project more than one half of their thickness.

Grinding reamer blades: Grinding reamer blades involves three distinct operations: First, radial size is obtained by cylindrical or circular grinding between centers, an operation pictured in Fig. 11. Next comes grinding the clearance behind the cutting edge to the "heel," leaving a narrow "land" directly behind the cutting edge as indicated in Fig. 12. This grinding is done preferably with a cup wheel as shown in Fig. 10. Finally, the chamfer or lead is ground. If the shank and body of a reamer are integral, center holes should be checked for burrs to assure the most accurate set-up for grinding concentrically. Shell reamers should be ground on an arbor reserved for the purpose and not on arbors used for reaming. As very little stock has to be removed with the radial grind, the infeed of the grinder should be light.

The cutting principles of a reamer are illustrated in Fig. 13. Referring to detail A, which shows an "all-purpose" grind of blades, chamfer M removes more than 95 percent of the stock on

Three operations in grinding reamer blades

the work being reamed, and cutting edge N, adjacent to the chamfer, removes the remaining stock and sizes the hole. From point N, the cutting edge tapers toward the other end of the blade, producing a clearance not exceeding .0015 in. in 3 in. The "two-lead" grind of blades shown in detail B, Fig. 13, is recommended for maximum precision and finish. The customary chamfer is the first lead, which does initial cutting. The second lead M, which produces the finishing cut, lies directly behind the chamfer and is tapered slightly toward the chamfer, the angle of the taper varying with the material being reamed. For example, a 3-degree taper is used for cast iron, bronze, aluminum and most nonferrous metals, while a 5-degree taper is more suitable for all steels and semi-steels. The length



Cutting edges are tapered

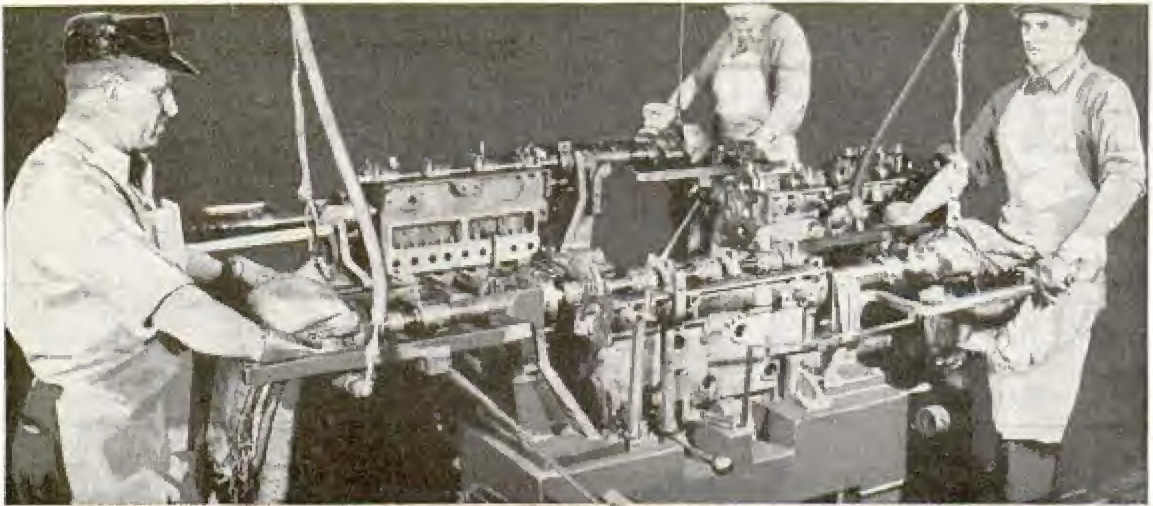
of the taper should be from $\frac{1}{4}$ to $\frac{1}{2}$ in., it being reduced with increased hardness of material. Section N can be straight but preferably tapered .0005 in. toward the other end of the blade so that the finishing cut is made at the high point of the blade where N and M meet.

The "land" or narrow portion between the cutting edge and the relief angle on the blade, Fig. 12, helps to guide the reamer in the hole and eliminates chatter. The land varies in width; when chips adhere to it the width should be reduced. General width recommendations are $\frac{1}{16}$ in. for steel, .01 in. for cast iron, .005 in. for bronze, .02

Land, heel, lip and chamfer

in. for copper. Aluminum demands practically no land at all. The heel, which provides relief clearance, should be .003 to .006 in. lower than the cutting edge; a 1-in. reamer requires .003 in. of clearance, a 2-in. reamer .006 in., and so on. A lip on the forward side of the blade as shown in Fig. 12, helps to ream soft materials, as for instance steel tubing, copper, bronze and aluminum forgings, and the like. Its angle should be from 5 to 10 degrees, as determined by experiment.

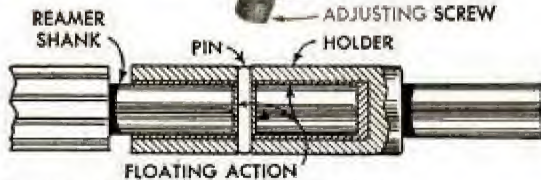
The reamer "floats": Often reamers are held in floating holders as shown in Figs. 2 and 15. The reason for this is that if a reamer were held rigidly it would be very difficult to locate it concentrically with the hole to be reamed, and any imperfect alignment would introduce error. Another reason for using a float is to compensate for the wear in the guiding ways or other



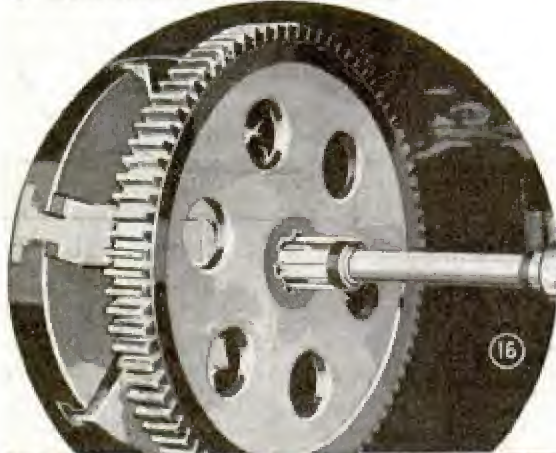
14

Adjustable reamers used in multiples

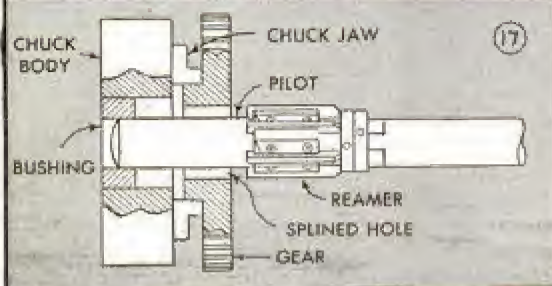
A-COMMERCIALLY
MADE FLOAT



B-CROSS-SECTION OF SHOP-MADE FLOAT



Reaming splined holes



parts of a machine. Therefore, instead of holding the reamer rigidly, a float provides a slight freedom of movement so that the reamer will adjust itself to the hole, the lands on the blades being an important factor in guiding it. Fig. 15-A shows a commercially made float but the one shown in detail B is shop made. The difference in size between the bore in the holder and the reamer shank is from .005 to .01 in., depending on the amount of floating action needed. The cross-drilled hole in the shank is larger than the pin, which also contributes to the full floating action.

Reaming splined holes: Fig. 16 shows reaming of a splined hole in a gear. In such cases it is absolutely necessary to provide a pilot for the reamer as shown in Fig. 17. Here a pilot of related length enters the bore of a bushing, which is fitted in the chuck body before the reamer starts cutting. Thus the reamer is held rigidly, and concentric with the hole.

Expansion reamers: To a slight extent, an expansion reamer can be called an adjustable reamer, although the amount of expansion seldom exceeds .01 in. The hand-expansion reamer shown in the photo of Fig. 19 and in detail A is being reset. This reamer does not cut at the end as other reamers do, but it cuts at the center of the fluted portion, this portion being expanded by means of the threaded taper plug. Expansion is facilitated by a number of slits milled all the way through to the taper hole. This type of reamer is always resharpened with no plug pressure to obtain a straight-cutting edge. Portions at both ends of the expanded portion provide the necessary clearance. There are also machine reamers of this type as shown in detail B, but in these the expansion

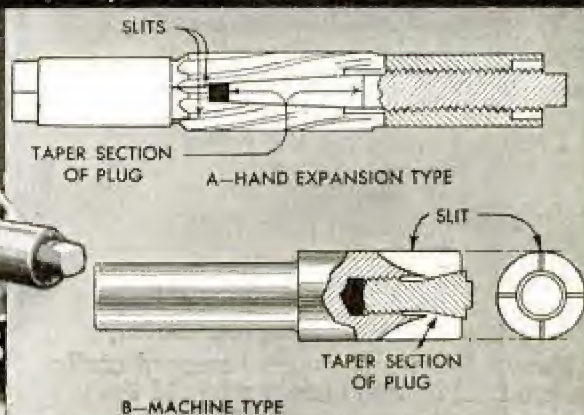
takes place on the end. This type of reamer is used mostly for repair work.

Wire drills as reamers: Frequently wire drills are substituted for small reamers, as in Fig. 18, which shows aluminum housings being drill-reamed. If the drill has been shortened considerably by repeated grindings, it will cut .001 to .0005 in. smaller than when new. New drills may be cut shorter for the purpose or almost any size can be had by oilstoning them. Both lips of a drill must cut alike.

Reaming speeds and feeds: As a reamer is only a sizing tool, the less stock it has to remove, the more feed and speed it will stand with relatively good results. If a



19 *Resetting an expansion reamer*



reamer has been reset accurately to size but reams oversize, it is apparently being over-worked. Reaming speeds should be kept relatively low to avoid crowding or tearing the metal by permitting chips to curl. If production rather than precision is at stake, the feed per revolution, but not the speed, should be increased. If reamers are kept in good shape, the feed should be held at a maximum because it is friction of the lands and chamfers against the sides of the hole that causes wear. Slow speeds and more-or-less heavy feeds always enable reamers to produce most work between grinds. With high-speed steel blades, a speed of 40 surface feet per minute, (s.f.p.m.) will be satisfactory for most metals of medium hardness. The speed should be 25 s.f.p.m. for extra hard materials, and between 75 and 125 s.f.p.m. for

nonferrous metals. Apprentice machinists can be governed by the following rule: Use a feed of .004 in. per blade for reaming freely cutting materials, and a feed of .008 in. per blade for hard ones, the total feed being determined by multiplying the feed per blade by the number of blades in the reamer. If a reamer has a tendency to chatter or cut roughly, reduce the chamfer angle and stone the corners to slight but uniform radii. Kerosene used sparingly has been found to be a good lubricant and will improve the finish.

☛ Kerosene or turpentine applied at the end of a drill will help when working on most hard materials. Reducing the rake angle of the drill lips to permit a heavier feed pressure without causing the lips to chip is another way of assisting the drill.

Portable Tray and Writing Board Handy When Taking Inventory



When taking inventory of small parts in bins, shelves and drawers, this portable unit will be very handy. It can be clamped instantly to the edge of a shelf or other suitable support for holding the parts as they are counted, and a writing board is always at hand for recording the count and kind of stock. The two clamps are made from pieces of flat iron as indicated, and are screwed to one end of the tray.

Stoneboat Made From Truck Rim Loaded and Dumped Easily

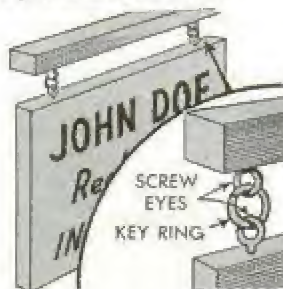
Heavy, loose rocks were removed easily from a field by one farmer who did the job without having to lift or roll them onto a stoneboat or wagon. Instead of the usual



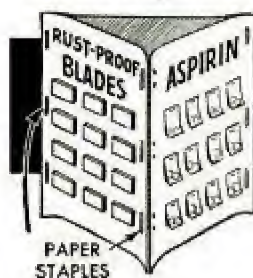
type of stoneboat, a large truck tire rim was used. This was fitted with a suitable handle and provided with a hitch for a horse. The rim is set over the projecting stone, which is then dragged off the field.

Key Rings Make Swinging Sign Safe and Easy to Remove

The problem of mounting a swinging sign so that it could be removed easily for painting and still have it locked securely in place so that it would be safe in a high wind, was solved by one sign painter who used small key rings to attach a sign as indicated. The sign and support were provided with stout screw eyes from which the sign was suspended by using the key rings as connecting links.



Display Cards Stapled Together Are Easy to Handle on Counter

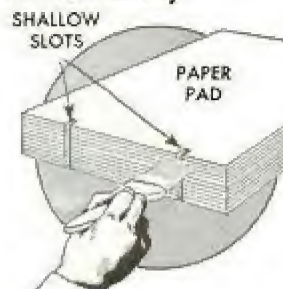


Annoyed by having easel-backed display and sales cards fall over when moved about on a counter, one merchant avoided the difficulty by assembling the cards in units of three, stapling the edges together as indicated. Thus, the cards were not only made self-supporting but also stimulated sales because they were easier for the customers to handle when examining the articles displayed.

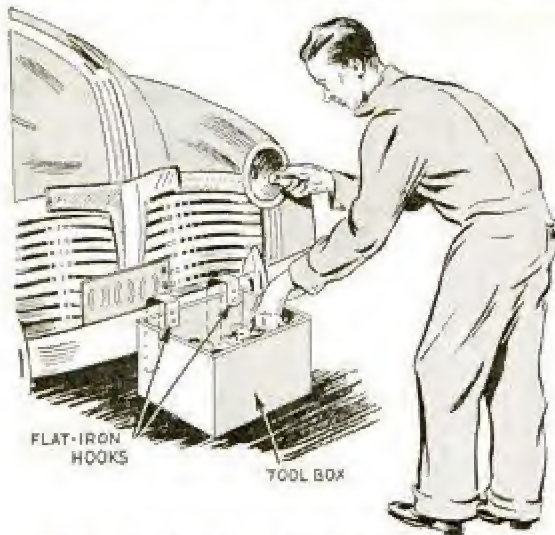
Thus, the cards were not only made self-supporting but also stimulated sales because they were easier for the customers to handle when examining the articles displayed.

Slots in Paper Pads Make Glue Hold More Securely

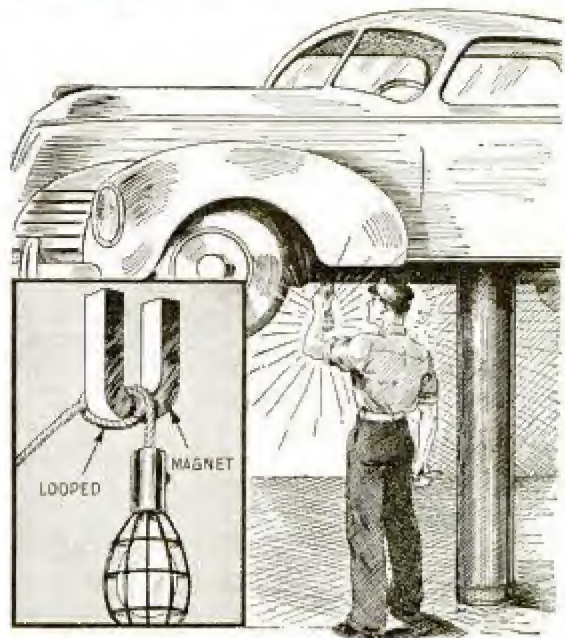
Confronted with the job of combining a number of statements in pad form, a printer conserved his gluing compound by cutting shallow slots in the pads on the miter saw. Then, by applying the glue over a small area at the slots, the pads were bound firmly without using adhesive over the entire end surface. The glue should be forced into the shallow slots to make the binding most effective.



Auto Mechanics Find These Four Kinks Handy



One mechanic who had considerable headlight repair work to do found the box shown above a time and labor saver, especially when working on a car outside the garage. It contains everything necessary, thus making extra trips inside the garage for parts and tools unnecessary. It hooks over the car bumper where it is conveniently within reach. It is a good idea to partition the box to keep the various sizes of bulbs separated, and also to protect them against breakage by coming in contact with the tools in the box. As shown in the upper right-hand photo, another mechanic used shower-curtain rings on the walls of a maintenance shop to hold a variety of gaskets, which often were damaged or lost when kept on shelves or in drawers. Also, it was found that the rings were ideal for the safe keeping of bills, receipts, memoranda, etc. The lower right-hand drawing shows how a mechanic solved the problem of hanging his extension light when lubricating a car on a rack. By looping the light



cord over a large horseshoe magnet, the latter could be stuck any place on the car chassis to hold the light in the desired position. With a slight alteration, a pair of inexpensive utility pliers can be made to serve the purpose of a pair of expensive battery pliers shown in the lower detail. On most pliers of this type, grinding off the ends of the jaws as indicated by the dotted lines in the detail is sufficient.



Waterproofing Car Stickers

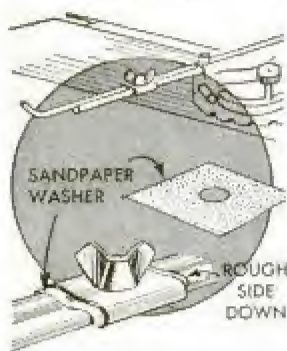
When moisture repeatedly collects on windshields during winter months, it often loosens the adhesive on windshield stickers, such as federal tax stamps, city licenses, etc., causing them to fall off or chip at the edges. To prevent this, coat the back of the stickers with clear fingernail polish, which provides a waterproof backing.

V-Block Unit Grips Round Work Firmly in the Jaws of a Vise



Often having occasion to cut rods of various diameters to duplicate lengths, one mechanic used a V-block unit like the one shown to grip several of them in a vise. In this way, considerable time was saved, as the rods could be handled without regard to diameter. The unit consists of two V-blocks assembled by means of a pair of flat-iron strips on two sides. The strips are slotted for screws, which are driven down to just permit a snug, sliding fit.

Stop Rod of Saw Miter Gauge Locked With Sandpaper



Difficulty in tightening and loosening the thumb nut on the stop rods of a saw miter gauge was overcome by using a sandpaper washer under the clamping plate as indicated. The paper pressing against the rods makes it unnecessary to screw the clamping block down as tightly as formerly required.

Waterproofing Fabric Car Tops

If the fabric top on your car leaks due to small cracks in it, but the top is still stretched tightly and is not torn, you can waterproof it with paraffin. First, clean the

material thoroughly with a stiff brush to remove loose dirt and grit and warm it in the sun. Then melt a pint of paraffin and brush this on. After the paraffin has soaked in, move the car to a shady spot and, when the paraffin hardens, give the top a coat of regular dressing. In this way, the paraffin fills up the tiny cracks and softens the material, providing a good surface for top dressing to complete the treatment.

Crayons "Key" Order Blanks

To keep a record of results obtained in different mailings of his circulars, one office manager keys the respective order blanks by making a mark across one end of the stacked blanks with a colored crayon. This applies a small, but easily distinguished color mark to each sheet so it can be checked with the record when received in an order. Different colors are used for various mailings, and further distinction may be made by applying the marking to the left or right.



Linotype Slugs Are Held in Galley By Spring-Type Paper Clamp

When carrying a galley of linotype slugs, or when moving it about on a stone, the slugs can be held in place by slipping a spring type paper clamp over one side of the galley. This provides a positive stop that is easy to remove or replace as desired.



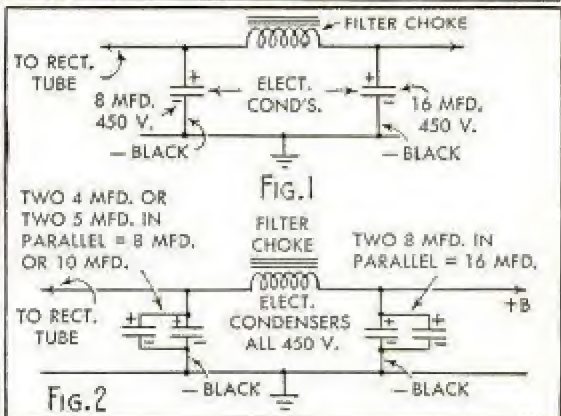
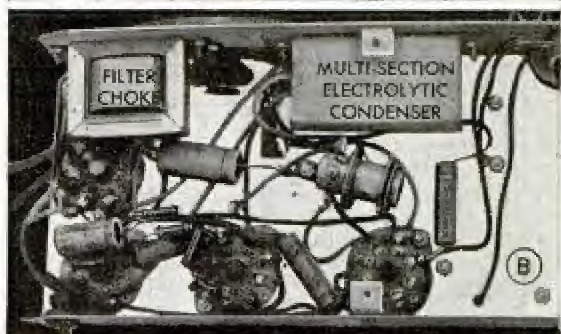
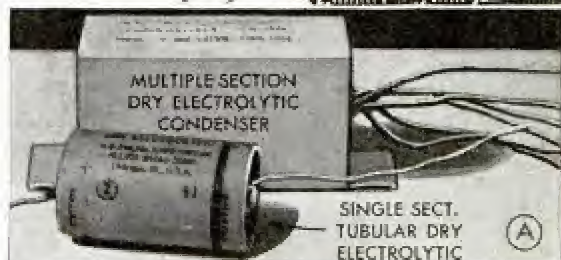


EMERGENCY SET SERVICING

WITHOUT a doubt the most common trouble in small sets, other than a burned-out tube, is a defective filter condenser in the power supply. Although certain capacities in electrolytic filter condensers are available for replacement purposes in both single and multiple section types, the particular combination you need may not be on hand. However, as an experimenter or serviceman you probably have other values of the same voltage rating that may be used.

For example, if the set employs the common arrangement of an 8 mfd. input filter condenser, and 16 mfd. for the second filter, as shown in Fig. 1, and the filter choke is in the B-positive side of the circuit, you may be able to parallel other smaller capacity values as in diagram Fig. 2. In making emergency filter condenser repairs the following points should be kept in mind: The voltage rating must be the same or higher; the total capacity of each condenser unit must not be smaller than that originally used, and the input filter condenser must not exceed the original capacity value by more than about 20 percent. However, the second filter condenser value may be twice that originally used and will give better filtering. Photos A and B show electrolytic condenser units and their approximate location.

If your set crackles as you tune in stations, dust may have settled between the variable condenser plates; disconnect the set and use the blower attachment of a vacuum cleaner as in photo C.



SIX-VOLT BLINKER and CODE

By Arthur I. Ratray

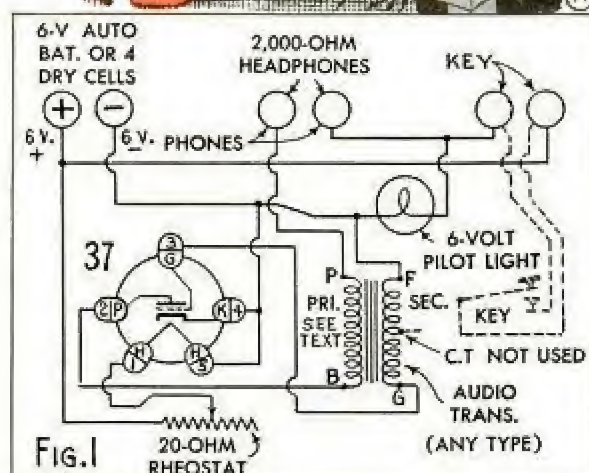


FIG. 1

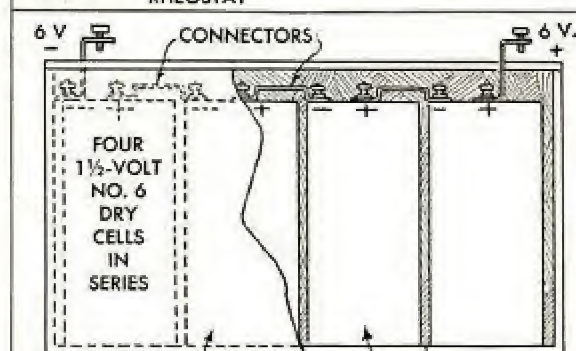


FIG. 2

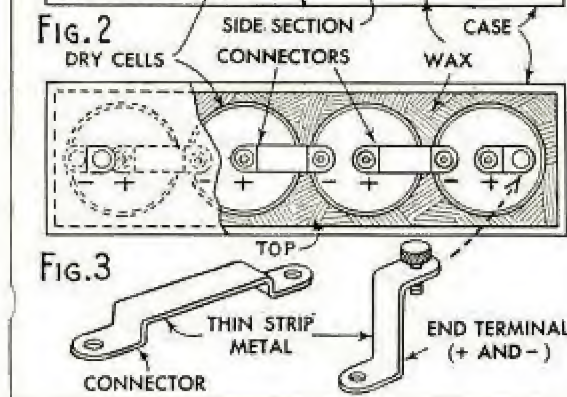


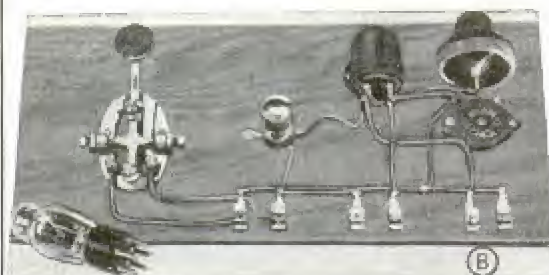
FIG. 3

ADAPTABLE to all code-practice applications, this unusually simple combination unit requires a minimum of parts and provides the radio student with a practical means of learning code by either the visual or audible method. Both systems can be operated by the same key either simultaneously or individually.

The oscillator tube puts out a clear-cut stable duplicate of actual radio signals heard on the air, as recommended by all radio code teachers, and the pitch of the signal can be varied to a pleasing tone to suit the student. This feature is an improvement over many previous types of code-practice oscillators that quickly tired the student who did not realize that pitch has anything to do with fatigue.

Either a type 37 or a 76 tube may be used, both of which are older varieties that can be salvaged from discarded sets, and are commonly found in radio experimenters' junk boxes. The audio transformer and 20-ohm rheostat are of the same noncritical order. If a 20-ohm rheostat is not at hand a 15-ohm, 1-watt, wire-wound fixed resistor can be used but, of course, this will eliminate the adjustable-pitch feature. A schematic circuit diagram showing a bottom view of the tube socket connections, appears in Fig. 1. The simplified wiring diagram, Fig. 4, and photos B and D are top views of the completed unit. Any insulated scrap copper wire, even ordinary bell wire, may be used for the connections to the various parts which are mounted on a thin piece of board so that the key will not be raised any higher than absolutely necessary above the top of the operating table.

Designed as a compact portable assembly to work on any 6-volt battery, the unit is independent of power lines and can be used with a car storage bat-

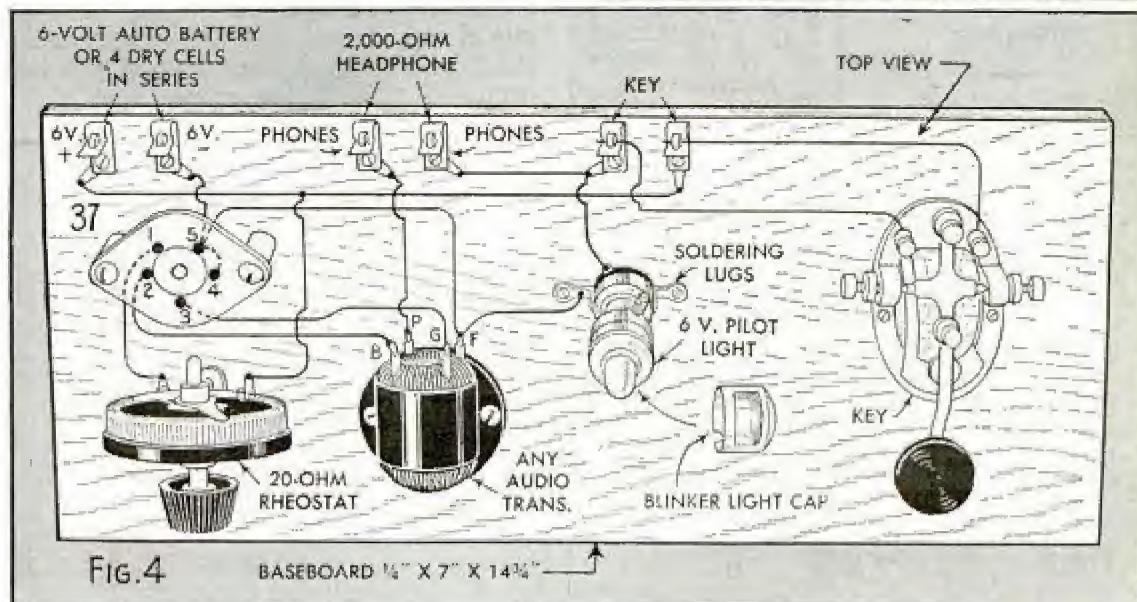


(B)

OSCILLATOR for STUDENTS

tery, a 6-volt "hot shot" battery or four No. 6 dry cells in series. A handy and compact portable dry-cell assembly, well protected from dampness, is detailed in Figs. 2 and 3. This 6-volt unit, suggested by L. B. Robbins W1AFQ, consists of four dry cells connected in series in a suitable container which is then sealed with a black wax compound obtained by breaking up an old B-battery and melting the wax. If a metal case is used, it should be lined with cardboard and cardboard separators placed between the cells. Solder the connecting strips to the battery terminals before pouring in the sealing compound. Positive and negative battery connections are then made with short leads to the clips.

To operate the oscillator only, as shown in photo C, unscrew the pilot light bulb $\frac{1}{4}$ turn in the hooded dash-light socket. The headphones can be any 2,000 to 4,000-ohm magnetic type; do not use phones of the crystal variety as the tube plate supply continuity is through the earphone circuit. Depress the key and set the rheostat at maximum or minimum, however an in-between setting will be found to give a pleasing pitch. It may be necessary to reverse the leads to the primary of the audio transformer to make the tube oscillate. For blinker-light code signals the key can be extended across the table, as indicated in sketch A; tighten the light bulb, and remove the oscillator tube.



"Big Town" Bike Receiver



THIS fixed-crystal bicycle receiver will bring in the local broadcasting stations as you ride around in any city where powerful stations are located.

Built into a 20-ounce tin can $4\frac{1}{2}$ in. long and $3\frac{3}{8}$ in. in diameter, there is sufficient room for an old midget-type .00025 mfd. variable condenser and other parts which are mounted on a $\frac{1}{4}$ -in. plywood disk panel in the end of the can. Housing details are clearly shown in diagram Fig. 1; the condenser plates must not touch the can at any point.

The porcelain stand-off insulator mounted over a large hole in the opposite end of the can insulates the threaded rod which is bolted to the coil form and provides the antenna binding post. The coil is wound on a 2-in. cardboard form short enough to slip into the can in an upright position, and should clear the bottom end of the can by at least $\frac{1}{2}$ inch. This coil is close-wound clockwise with either No. 28 or 30 silk or enamel covered scrap wire; 20 turns are required for L_1 and approximately 80 turns for L_2 . The detailed non-critical parts list is R-320, if desired. The coil form is supported by a small bracket on one of the C_1 condenser terminals, and bus-bar leads so that the entire assembly can be removed from the can merely by removing the panel screws and the hex nuts on the connecting rod. One end of coil L_1 is grounded to the can on one of the panel screws. A schematic circuit diagram appears in Fig. 2.

The bicycle frame mounting clamps for the set and whip antenna are detailed in Figs. 3 and 4; and a sketch of the front panel is shown in Fig. 5. The can may be enameled to match the frame, however one clamp, the can and the bicycle frame should be scraped clean at one point to ground the can to the frame.

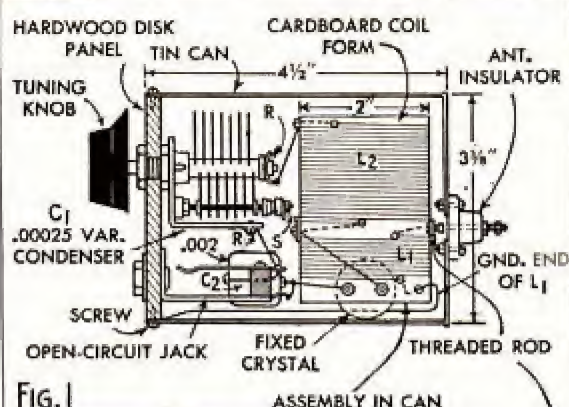


FIG. 1

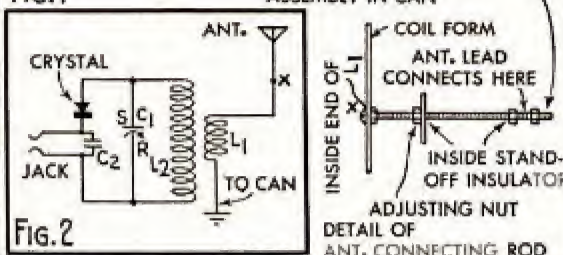


FIG. 2

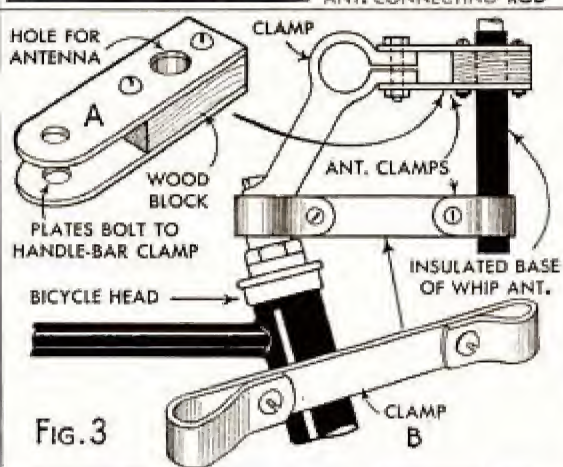


FIG. 3

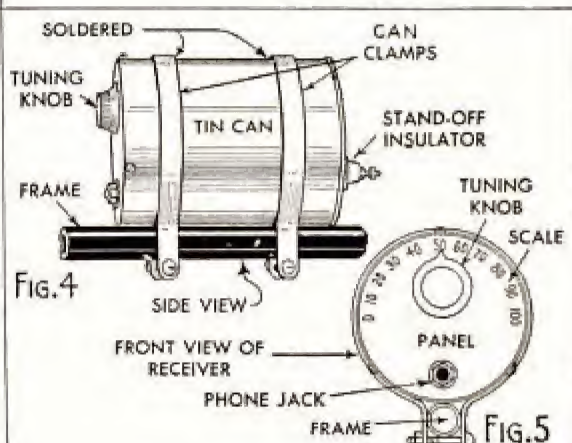


FIG. 4

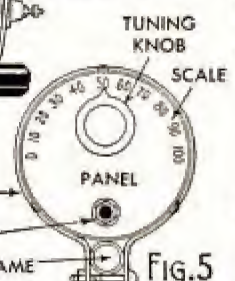


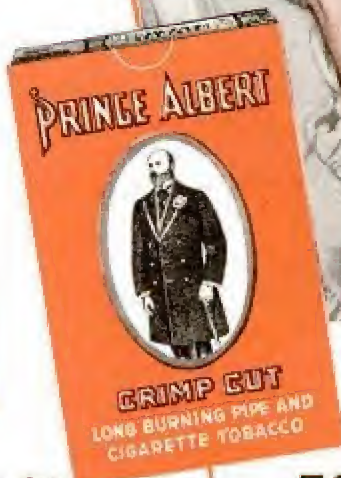
FIG. 5



Pretty Special!

The man with

Pipe * Appeal



WOMEN have an extra smile for the man who smokes a pipe. Keep 'em smiling! With real PIPE APPEAL—Prince Albert's fragrance, bland aroma. And favor yourself with P. A.'s no-bite mildness—the rich taste that comes through so mellow. Prince Albert outsells every other smoking tobacco—it's the brand for all-out PIPE APPEAL!

50 pipefuls of fragrant tobacco in every handy pocket package of Prince Albert

70 fine roll-your-own cigarettes in every handy pocket package of Prince Albert

*Try P.A. for
MILDNESS
and that
choice-tobacco
RICHNESS!*

BUY WAR BONDS
AND STAMPS!



PRINCE ALBERT

THE NATIONAL
JOY SMOKE

R. J. Reynolds Tob. Co.
Winston-Salem, N. C.

PROTECTING REPAIR



In motorized warfare, the maintenance and repair of motor vehicles is the responsibility of Army repair stations.

Delivering repair parts to these remote stations in usable condition has been a battle against such foes as the rigors of long sea voyages, rust, corrosion, rough handling, and attacks by the elements. For unless the ravages of salt water, dust, extremes of heat, cold and humidity could be prevented, vital replacement parts would quickly become so much useless scrap.



At the outset of war, Army officers experienced in the difficulties of truck servicing at remote places, and Chrysler Corporation Parts Division packaging engineers collaborated in solving this problem. With the added help of Chrysler Corporation Research Laboratories, a system of packaging was devised that assures arrival of repair parts in good condition.

Even though these precision-built parts may have to be unloaded in angry surf, hauled through jungle, stored in damp caves or stacked under the stars, their scientific packing assures complete protection from the elements, as well as making it easy to find the right part when needed.

WAR BONDS ARE YOUR
PERSONAL INVESTMENT IN VICTORY

CHRYSLER CORPORATION

PLYMOUTH • DODGE

PARTS — for Delivery Overseas!

Surface Protection, Wrapping and Sealing Becomes a Fine Art...

The first step is to apply a rust and corrosion preventive to all metal parts. Then a moisture-resistant, chemically-prepared covering is employed for wrapping each part. This wrapper gives two-way protection. Neither external moisture nor internal condensation and "sweating" can affect the part.



Transporting Ashore and Over-land Requires Compact, Easily Handled Units

Each packing case is so designed that it saves up to one-third in cargo space. Handling is made easy by using only small-sized cases that can be ferried ashore in small native craft and carried to almost inaccessible land destinations.



Ingenious "5-Way Barrier" Adopted as Standard Overseas Packing Method...



A tailor-made carton is then provided for each type part. These cartons are placed in space-saving packing cases with moisture-proof liners. The overall five-way protection... rust proofing, wrapping, packaging, internal liners and the outside case—plus protection against mechanical damage—also acts as a shock absorber against rough and swift handling.



Fresh Air Repair Depots Function Smoothly...

Finding the right part quickly has been simplified by a code system for rapid identification of case contents. Weather-proof metal plates, attached at the factory, provide full descriptions. Each carton within carries its individual identification. Because of scientific protection, parts supplied to repair crews are in as fine condition as those used on Chrysler Corporation production lines.

War products of Chrysler Corporation range from little bullets to big tanks:
Tune in Major Bowes every Thursday, CBS, 9 P.M., E. W. T.

DE SOTO • CHRYSLER

HOW TO GRIND CUTTERS FOR WILLIAMS' TOOL HOLDERS



FREE! WILLIAMS' TOOL DATA SHEETS

These two Williams' Tool Data Sheets graphically explain how to grind cutters—give correct included angles, clearances and rakes. Also instructions for set-up and use. Other Data Sheets are listed below. Circle the number of those desired on coupon and mail today. They're punched for 3-ring binder.

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| 2. Data on Williams' Boring Tools. | 10. Data on "Vulcan" Eye Bolts. |
| 3. Data on "Vulcan" Chain Pipe Tongs. | 11. Data on Williams' "C" Clamps. |
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Seeing Is Believing

(Continued from page 47)

ical contrivances in his pre-Army days, designed the midget amplifying device.

Private Forrest Curlee, formerly of the Berkeley Police Department short wave radio station, and the California State Highway Patrol, qualified for service in the synthetic aids laboratory because of his skill as a model builder. As a civilian, Curlee made a miniature railroad, with locomotives, tenders, freight and passenger cars built to scale. His tachometer mock-up, has a section of its housing cut away, and a Plexiglas backing which makes the inner parts visible.

Most delicate of the mock-ups are the navigation instruments which have been built by Private Volney I. Morrison and Private Jack Labes, both manufacturing jewelers before they entered the Army.

They now work with Plexiglas instead of metal, and make transparent housings for such instruments as gyroscope compasses, artificial horizons and turn indicators.

Private Labes is currently duplicating the artificial horizon, essential to pilots when the natural horizon is not visible. Ordinarily, the face of the instrument is visible. The Plexiglas housing permits students actually to see the wheels, cogs and the gear inside, and hastens their understanding of the device.

Private Morrison has built an altimeter in which the operation and function of inner mechanisms are visible.

Also completed is a gyroscope compass, or turn indicator. By applying the nozzle of an old vacuum cleaner, a jet of air is drawn inside the casing and directed against a gyroscopic rotor which spins exactly as do the rotors in actual flight. Students can watch the instrument in operation, and can establish the relationship between the whirling flywheel and the face of the appliance.

The Plexiglas used in the laboratory is the same material that forms the transparent nose of Army bombers. When warm it can be molded into almost any shape. The ends can be welded together, or pieces can be fixed into place with a cement made by dissolving Plexiglas shavings in acetone.

Lieutenant Dixon is completing a condensed mock-up of an airplane in which the Plexiglas instruments will be mounted in a Plexiglas panel. The model plane will be mounted on a swivel. Each operating part will be synthetically motivated. With this contrivance almost every problem encountered in flight can be visually demonstrated before students on the ground.

CHAMPION SPARK PLUGS

ON ACTIVE DUTY ON THE HOME FRONT!

Here at home, Champion Spark Plugs "Back The Attack" in buses, cars, trucks, tractors, planes, stationary and marine engines of every type, delivering manpower and horsepower to tasks vital to Victory. In engines of every size and type, Champions are maintaining their long established reputation for better performance, greater dependability.



IN THE AIR. The air transport lines are one of our most important means of transportation. Dependable Champion Spark Plugs are enjoying rapidly-growing favor with leading air line companies.



ON THE FARM. Short of manpower, and with the imperative need for unprecedented food production, the farmer knows he can depend on Champion-equipped power-driven equipment.



IN INDUSTRY. Champion-equipped engines furnish dependable emergency power in "stand-by" plants in thousands of industries and utilities.



IN TRUCK TRANSPORTATION. The nation depends on truck transportation as never before. Here again dependable Champion Spark Plugs excel and are preferred.



IN CIVILIAN TRANSPORTATION. War workers depend on their own cars in driving groups to get them to and from work, and everyone knows Champions are a dependable source of efficiency and economy.



ON CONSTRUCTION JOBS. Champion Spark Plugs are the source of dependable performance in thousands of heavy duty industrial engines like the one that powers these pneumatic hammers.

BACK THE ATTACK — WITH WAR BONDS

Avoid those "Fuel Shortage Blues"



KEEP WARM WITH BALSAM-WOOL ATTIC INSULATION



You can keep your spirits high when the thermometer outside is low, if your house is free from shivers. Balsam-Wool Insulation will make your home warmer, more comfortable—on less fuel.

Laid in your attic like a rug, Balsam-Wool guards your comfort and saves you money, year after year. That's because it is the original sealed Attic Insulation—windproof, moistureproof and fire resistant—with quality proved in hundreds of thousands of homes.

Balsam-Wool is sold under a money-back guarantee of complete satisfaction. Order now—see your **lumber dealer** about easy monthly payments or mail coupon.

Balsam-Wool

SEALED INSULATION

WOOD CONVERSION COMPANY
Dept. 210-12, First National Bank Bldg.
St. Paul 1, Minnesota

Gentlemen: I want to know more about Balsam-Wool Double-Value Attic Insulation.

To assist us in giving you special information, please check: I am a home owner ☐, renter ☐, architect ☐, student ☐, contractor ☐.

Name

Address

City State



War Work Set to Music

(Continued from page 43)

range of music is wider than that of factory sounds, music doesn't add to the noise but is heard plainly.

"It also is a fact that persons working in certain degrees of noise grow accustomed to that noise and, consequently, can hear another sound over it. In unusually noisy departments, special speakers pipe music through terrific din. Plant broadcasting equipment recently was installed in a Chicago machine shop where a noise level of approximately 105 decibels prevailed."

Transcriptions and records are used most generally in plant broadcasting. Automatic record-changers are widely employed. A few companies have arrangements with local radio stations to broadcast programs to the workers.

In the United States, no concerted attempt has yet been made to carry "music while you work" programs over national hookups. In England, however, the British Broadcasting Corporation has special musical programs for workers which are piped into most war plants.

The relationship between music and work is by no means new. As far back as 1915, Thomas A. Edison conducted a series of experiments, using the Edison phonograph. At one time he began compilation of a catalog of "mood music" for workers.

One of the first American companies to install plant broadcasting was Westinghouse when, in 1925, a loudspeaker system was tested in the company's plant in Newark, N. J. The idea is believed to have originated when a Westinghouse official visited a tobacco factory in Cuba and found cigar-makers taking turns reading and singing from a high platform in the center of the floor, thus keeping the workers' minds alert and their fingers moving in rhythm with the speaker or singer.

A scientific music test reported by the Medical Research Council of the London Industrial Health Board revealed production increases of 6 to 11 percent when music is used. Seventy-five percent of English plants using music stated that it increased employee efficiency.

J. N. Langdon and S. Wyatt of the council reported:

"There seems to be little doubt that music will be increasingly used as a means of making work more attractive and enjoyable. In most cases, it also will result in increased output, but even if production should remain unaffected, the benefits derived by the employees would still justify its adoption as an accompaniment to work."

Get Ready Now

FOR HARD STARTING WEATHER!



CASITE GUARANTEES

SUMMER STARTING IN WINTER WEATHER

OR *"Double Your Money Back"*



Right now — before real cold weather starts, ask about Casite's Winter Starting ability at your car dealer, service station, or garage.

Casite does two things which make any motor start better—and run better. First, it cleans out sticky, power-destroying sludge and gum from vital areas; second, it makes oil free-flowing, insures lubrication of high-friction parts.

Casite easy cold-weather starts save your battery, save your motor, save your disposition.

Remember... WE GUARANTEE

That any motor capable of being started in a warm room will start in the coldest weather when Casite is added to crankcase. Add Casite according to instructions. If your car fails to start, you get double your money back by filling out guarantee certificate and mailing to The Casite Corporation, Hastings, Michigan. Maximum refund is \$1.30 per pint, which is twice nationally advertised price of Casite.

THE CASITE CORPORATION • HASTINGS, MICHIGAN



CASITE

CLEANS OUT MOTORS
KEEPS MOTORS CLEAN

GET CASITE... AND GO!





I know what Freedom means

I'm lonesome, and sort of scared.

This morning the Boss put me in this crate, and right away I knew something was wrong. Then he scratched my ears longer than usual, all the time with a strange, extra-serious look in his eyes.

He said he was going gunning for varmints, and I started to get excited. But he said no, these were a different breed. Two-legged ones. "And, Jeb," he said, "you're going to live with strangers till I get back. Be a good dog about it." He talked a lot about *freedom* . . . and how, if he didn't win out over those varmints, he'd probably be in a crate, too, and strangers would be shouting orders at him.

Well, I know what freedom means, and I want it . . . for me and for the Boss. I want to be free to run through my favorite fields and woods again. Free to nose after quail.

The Boss said he'd come back to me . . . that life would be the same again, or better. So I'll be waiting . . . no matter how long it takes!

Here at Remington we are thankful that we are able to help Uncle Sam go gunning after those "varmints" . . .

1. Every working day, Remington produces thirty million rounds of military small arms ammunition.

2. And, every working day, Remington produces more than enough military rifles to equip an entire infantry regiment at full fighting strength.

But, after the war is won, we will welcome the return to our peacetime business . . . when once again we can serve our sportsmen friends with Remington shotguns and rifles, Nitro Express shells, Kleanbore Hi-Speed .22's, and Core-Lokt big game bullets. Remington Arms Company, Inc., Bridgeport, Conn.

"Nitro Express," "Kleanbore," and "Hi-Speed" are Reg. U. S. Pat. Off.; "Core-Lokt" is a trade mark of Remington Arms Co., Inc.

Remington



Umbrella Army

(Continued from page 25)

Those who laugh are ostracized."

The Yankee paratroopers laugh. Theirs is one of the most dangerous specialties in the army, but every chutist is a volunteer, lured by the Yankee spirit of high adventure—and maybe the paratrooper's bonus of \$50 a month. Some of the glamor goes out in the training camps where toughness is built-in. It is not glamorous to march 25 miles a day through the almost tropical Carolina sand hills, carrying a 60-pound pack, and sleep on the ground while a cloudburst drills down on the pup tent; nor to dog-trot an hour with the sun beating a 100-degree tattoo on the pavements of Camp Mackall. Yet they tell of one he-man so explosive with energy that, after a day's routine that would kill an average man, he sheds his jump boots after evening mess and lopes barefoot along the road for the love of it in the free hour when any normal being would be flat on his back with a book or radio for company, or just a gal's picture. Of such stuff are Yankee paratroopers made.

Practical jokers have a grand time in the Airborne Command. One of the favorite stunts is to walk up to the door of a C-47 just as one of your mates, his parachute pack hooked to the static line, steps to the opening to bail out, and remark casually as you show him your own unattached line, "Pardon me, is this yours?"

They played a trick one day on an officer about to jump. They tied up the supply-bundle parachute so it wouldn't open, dumped it out, and then all gasped as the bundle plummeted down without benefit of umbrella.

"It didn't open!" someone cried. "You'd better not jump, sir."

But he did. He could take it.

The paratroopers got a big laugh out of one tail gunner who turned up missing after a bombing mission over Africa. He came walking in, looking plenty sorry about the whole thing. He had awakened suddenly from a comfortable nap in his tail turret, thought he heard the bell signal for an emergency bail-out, and hit the silk.

They tell another one that's hard to believe, but it's sworn to by some of the ranking officers at Airborne Command Headquarters. A paratrooper stepped out the exit one day wearing his glasses. The wind whipped them off. One hundred feet down, his back pack yanked open and the silk billowed out. As he drifted down he spied his glasses fluttering down like a flat

(Continued to page 154)

AUTO-LITE SPARK PLUGS

IN SERVICE ON EVERY FRONT



"We 'uns promised the blood bank a quart . . . reckon Paw has any?"

GASOLINE DONORS CAN HELP, TOO!

Become a gasoline donor by giving your spark plugs a "Plug-Chek." Tests conducted by The American Automobile Association show Auto-Lite "Plug-Chek" Inspection Service can increase gas mileage as much as 12%!

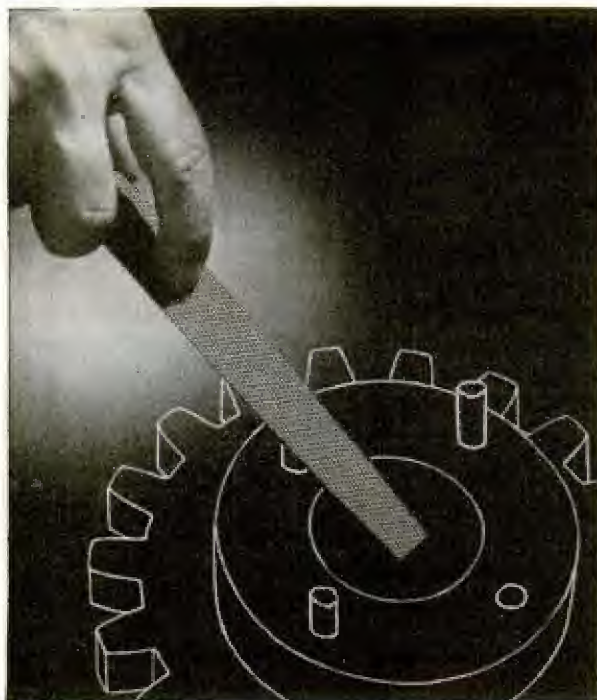
As simple an operation as cleaning and regapping your present plugs may do the trick. A proved inspection service, "Plug-Chek" is exclusive with Auto-Lite Spark Plug Dealers.

Stop for a "Plug-Chek" today—and if new plugs should be installed, insist on Ignition Engineered Auto-Lites!

THE ELECTRIC AUTO-LITE COMPANY
TOLEDO, OHIO • Merchandising Division • SARNIA, ONT.



Color and condition tell if plugs are operating properly. Matching your plugs with those illustrated on the "Plug-Chek" is the first step in getting new life for "spark-weary" engines.



FILES FOR PLASTICS

PLASTICS . . . an immense new world of industry is advancing under the steady development of this multi-purpose material. Many types, with remarkable characteristics, are rolling out of the engineering laboratories . . . vying with aluminum, steel and other metals in the manufacture of thousands of products.

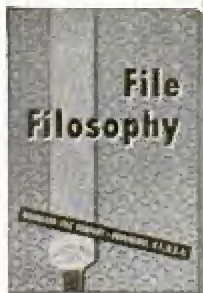
Plastics finishing and fabricating call for various shapes and cuts of files—for sprue and flash removal; for smoothing and reaming; for work in corners and notches; for hard and soft compositions.

Files for plastics must have a "dry" (not "oiled") finish; and to overcome clogging when used on soft or "shreddy" material, they need well-spaced teeth. To combat the abrasive action of certain thermoplastics, teeth must be hard and thin-topped to maintain sharp cutting edges as tips wear down.

FREE BOOK "FILE PHILOSOPHY"

Tells about many regular and special purpose files; how to use and take care of files; how to select the right file for the job. Useful to production and purchasing heads. Invaluable to mechanics, toolmakers, die-makers, saw filers, repairmen, mechanical "trainees."

NICHOLSON FILE CO., 22 Acorn St.
Providence 1, R. I., U. S. A.
(Also Canadian Plant,
Port Hope, Ont.)



NICHOLSON
FILES FOR EVERY
PURPOSE

NICHOLSON
U.S.A.
MADE IN U.S.A.

pebble in the old swimming hole. He grabbed them and put them back on.

Another authenticated yarn is that of the fighter pilot who came down on a New Guinea field with his landing gear crippled, made a bad bounce and pulled up again. At the top of the rise he bailed out, but too close to the ground to open his chute. Below him his plane crashed, exploded, and the blast blew the chute wide open. He landed safely.

Captain Tipton is another who led a charmed life on anything but charming day. He was at El Guettar with the infantry and armored forces on April 1 when they were fighting eastward to meet the British Eighth Army.

"The air was full of butterfly bombs and 500 pounders," Captain Tipton related. "The Germans timed their attacks precisely, and would send their bombers over just when our planes were heading back to base.

"In one of those intervals we saw 14 silver Heinkels coming over. They were beautiful if they were German, but there wasn't time to admire them. I was in a jeep, and told my driver to take cover. I looked around for a fox hole but couldn't find any. I did find an eighteen-inch depression in the mud left by a tank track, and dropped in it. My driver ran back to the car just as a 500-pound bomb plumped into the ground 25 feet from where I lay. It lifted me off the ground and dropped me back, dazed, but unscathed. The bomb left a crater 18 feet wide and five feet deep.

"The driver was not in sight. For 30 minutes I hunted for him, but there was no trace.

"Later the same day I was driving a jeep, alone, when a shell hit under it. I thought it was a land mine, but some fellows nearby saw it fall and the jeep rolled over it just as it exploded. It knocked the gas tank off and wrecked the jeep, but it didn't catch fire. I wasn't scratched."

Despite the extra hazards of their profession, the paratroopers on their baptismal adventure in Africa sustained casualties at a lower rate than any other branch. The dash across Europe ended in Algeria with nine out of 500 killed—none in jumping; four died in the ambushed plane, four in a truck, one was shot accidentally; 69 were wounded. Failure of parachutes doesn't happen. In 400 jumps 17 men were injured, none killed.

A paratrooper is a highly and expensively trained soldier, and the army is in need of more like him—particularly officers. Consequently he is well cared for and thoroughly schooled in how to take care of

(Continued to page 156)

TOUGH...BUT OH SO GENTLE



PROTECT YOUR PRECIOUS MOTOR

Your car, truck and tractor motors are precious. They must be watched, protected—their long life insured.

Watch the piston rings, especially. At the first sign of oil-pumping or loss of power, install new rings. They'll save oil and fuel, and check cylinder wear.

Hastings Steel-Vent rings enjoy wide preference

among farmers from coast to coast. They've proved their economy, long life and dependability—under every farm condition.

It will pay you to specify Steel-Vents—whenever you install rings.

HASTINGS MANUFACTURING COMPANY, HASTINGS, MICH.
Hastings Mfg. of Canada, Ltd., Toronto

It's a privilege to buy War Bonds

HASTINGS

STEEL-VENT PISTON RINGS

Tough on oil-pumping. Gentle on cylinder walls

Tool Tips by **STANLEY**

Know How to Sharpen Plane Irons or Chisels

Unnecessary grinding of chisels and plane irons wears them out prematurely. If they have simply become dull in use, whetting will restore the sharp, keen edge desired.

GRIND THEM ONLY WHEN

1. The cutting edge is nicked.
2. The bevel has become blunt due to whetting at the wrong angle.
3. The bevel has been rounded by careless whetting.

Tools are vital to Victory. Care for them and use them properly—to make them last for the duration—to avoid waste of scarce metals.

Complete instructions for grinding and whetting edge tools are included in the **STANLEY TOOL GUIDE**, a 32-page handbook for the home craftsman. Simple explanations, thoroughly illustrated, tell how to use and conserve all types of tools.



STANLEY TOOLS

DIVISION OF THE STANLEY WORKS
105 ELM STREET
New Britain, Conn.

himself. Before he makes his five qualifying jumps he is taught all the army knows about how to land safely. The principal hazard is a broken limb. A common cause of bad landings is the tendency of the chute to sway, putting the unskilled jumper down backward. One way to avoid it is to pull on the forward lines during the fall; this spills air from the front of the umbrella and enables the jumper to fall forward. Picking a nice place to land is a happy idea, but not practicable. Approaching the objective, the pilot of a troop carrier drops to hedge-hopping level, cruising at about 145 miles an hour. About three minutes from the goal the plane levels off at 300 feet and the red "ready" light shows at the cockpit door. Over the objective, the pilot turns on the green light; then it is up to the jumpmaster. There is no second pass over the objective in combat. In 10 seconds 18 men pour out. They may control their forward fall, but there is little chance to pick a soft landing in enemy country and in darkness.

A few recommendations for "safety first" were given the trainees at Camp Mackall by Lt. Col. H. H. Cartwright in a memorandum on jungle landings: "The first essential is to put yourself down with the minimum of damage. The methods vary according to the ground. In forest, remember the trees are hard, and avoid them as far as possible. Do not try to land on top of a tree. The branches or broken ends are stronger than the fuselage covering your bones or glider.

"In bamboo forest, come in slow, and try to sit on top of a clump. You will be stronger than the bamboos, which are very springy and strong in bending and will act as a cushion. It is not likely any will come through and impale you. Only on beaches should an ordinary landing be attempted; then make certain the sand is hard. Several in Malaya landed on quicksands and were drowned."

Normal technique for the paratroopers is to bail out and seize an open area, then reinforce it with troops and peeps and small guns landed by glider when the field is under control. These big gliders, opening up in front to accommodate the quarter-ton peep, are towed by the C-47, which has a cable winch in its tail and can tow the glider aloft from a standing start or by flying pick-up, although the latter method is not yet standard practice.

Mortars, light machine guns and the famed "bazooka," go with every battalion. The paratroopers were among the first to spring the bazooka on the Nazis, and it

(Continued to page 158)



HELLO BOYS!

the world's greatest toy factory is fully enlisted for war production...but toys from unrationed materials are still coming from the **GILBERT HALL of SCIENCE**

A.C. Gilbert

PRESIDENT
The A. C. Gilbert Company



The Army-Navy "E" Flag, won by Gilbert workers for high achievement in war production.

ERECTOR JUNIOR
builds big action models

NEW **ERECTOR** JUNIOR

"Just pin-peg parts together"

It's a snap to build thrilling action models with Erector Junior . . . bridges, cranes, airplane ride, dozens of others. Fascinating array of punched strips, wheels, axles and other exciting parts. Made of wood—like famous mosquito bomber. Parts fasten together with big, easy-to-grip pin-pegs. You don't need a screw-driver.



AMERICAN FLYER TRAINS and ERECTOR

American Flyer Trains and Erector not made this year. Our fighting men need the metal.

Reveals Nature's Secret Colors

GILBERT CHEMISTRY SETS



the kind that bring boys fame.

Here are Burton Feinerman and Hans Mark, who won \$100 for chemical research this year. More boys have won fame and big awards with Gilbert Chemistry Sets than any other kind. They are more than "toy sets." Write messages in fire ink. Make chemical weather flag. Hundreds of other spectacular experiments. Write for details on \$200.00 in cash awards offered to boys doing most important research in chemistry in 1944. Address Gilbert Hall of Science, Erector Square, New Haven, Connecticut.



NO. 6 DOUBLE FEATURE, DOUBLE FUN LABORATORY
Big two-door wooden cabinet crammed with chemicals and apparatus. Over 400 spectacular experiments.

It's fun to master **CHEMICAL MYSTERIES**

They're keen...these **Gilbert POLARIZING MICROSCOPES**

You open the door to a new wonderland of Nature's hidden colors with a Gilbert Polarizing Microscope. Objects appear 150 times larger. They blaze forth in startling colors never seen with the naked eye or ordinary microscope. Each specimen brings new thrills.



UNBEATABLE COMBINATION for easy hack sawing



TUF-FLEX Super-tough, super-flexible

EVEN IF you don't have a Millers Falls hack saw frame, you can make sawing easier with the right blade, for it's the blade that does the work. For general tinkering in the home or at the workshop bench — or for off-and-on maintenance use on a wide variety of metals — you can't beat Tuf-Flex. Like no other blade, it tackles tough tool steel, BX, pipe, or hard angle irons — and walks through them all in the same easy way. Won't strip, won't break. For steady cutting of one type of work, you'll prefer Millers Falls Blu-Mol blade . . . but for general use on different materials, Tuf-Flex is the choice; a single blade will probably serve you for months, 8, 10, or 12 inches long; 14 to 32 teeth per inch.



FOR REAL hack-sawing ease, you need both the Tuf-Flex blade and a good frame. Finest of all popular-priced frames is Millers Falls No. 48 — not expensive, a quality frame without frills. Unusually rigid, fine balance; comfortable plastic handle, guarded pistol-grip, checked for firm hold. Frame is polished, nickel-plated, and buffed — you'll be proud of it. Adjustable for 8, 10, or 12 inch blades.

MILLERS FALLS TOOLS

SINCE
1868

MILLERS FALLS
COMPANY

Greenfield, Mass.
U.S.A.

proved one of the great secret weapons of the war. It can penetrate any tank it has met, and burn out all life within it.

Algeria and Tunisia were high school for the Airborne Command. That they learned the game well is testified by one high officer who said: "One company of our parachutists was worth any three companies of infantry in Africa."

They have that to live up to when the great armada of airborne troop transports rains fighting Yankees down on the enemy's home grounds in the last inning.

If the Axis Uses Gas

(Continued from page 31)

The mortar thumps nine times, and an exact line of smoke, bursts spaced as evenly as though marked off by a tapeline, begins to obscure a half-mile front on the water. To keep the smoke there, the crews could traverse back, dropping the next rounds in the spaces between those nine bursts.

Smoke is used to blind the enemy or hide your own operations. To obscure rear installations, the C.W.S. uses a mammoth smoke generator, like a steam roller on rubber tires, that throws out enormous quantities of smoke and has been known to obscure objects 15 miles away. Its smoke is harmless. Vaporization of special oil and water creates a persistent, blinding fog.

More familiar weapons of the C.W.S. are the incendiaries. Col. G. J. B. Fisher of that service has declared that incendiary bombs were more effective in damaging Germany's Ruhr than high explosive. One novel incendiary is a 6-pound oil bomb, trailing long muslin streamers—like disheveled hair—to make it fall nose down.

Newest of the flame throwers uses a mixture of gasoline and a chemical jelly, an adhesive fuel that sticks right on the target and continues to burn when the jet is turned off. A spark-plug switch sets off the weapon.

"Heat inside a pillbox covered with the burning fuel soon would become unbearable," officers assure you, and you can believe it. Even in the open air, and a good 50 feet to the side of the cascading fire, you feel the heat from an open furnace door.

Chemical warfare isn't new. From biblical times armies have used flaming oil and resin-straw fireballs as incendiaries. Aeneas, the Trojan king, about 360 B.C. employed a fiery composition of pitch, sulfur, tow, resinous wood, and other substances easy to ignite and hard to extinguish, to pour upon besieging armies trying to scale the barricades.

(Continued to page 160)

"HOME WOULDN'T BE HOME WITHOUT A HARLEY-DAVIDSON"

A LAD in our Armed Forces wrote us this letter:

"My job is motorcycle inspecting. Harley-Davidsons are sure doing a swell job in the Army. You wouldn't have to ask why, if I could take you with me on one of my test rides. There's where Harley-Davidsons show what they've got."

"I sold my Harley-Davidson when I entered the Armed Forces, but you can bet your bottom dollar that one of the next new Harley-Davidsons after the war will be mine, because home wouldn't be home without a Harley-Davidson."

That letter makes one of the best advertisements ever written about the dependable performance of Harley-Davidsons. All we can add is — "Put your fighting dollars in War Bonds and own a Harley-Davidson after Victory is won!"

Mail the coupon today.

HARLEY- DAVIDSON MOTORCYCLES

HARLEY-DAVIDSON MOTOR CO.
Dept. P, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page "Enthusiast" Magazine, filled with motorcycle action pictures and thrilling stories.

Name.....

Address.....

City..... (.....) State.....

**SEND COUPON
NOW**

FREE!



"Yankee" Fine Mechanics' Tools have contributed to the efficiency of American production for nearly half a century . . . are now working day and night to speed the output of war. Without proper care, however, no fine tools can withstand the punishment of all-out production—and "Yankee" Tools are no exception. Their ingenuity will save time and trouble on the job—if you take the time and trouble to "Treat 'em Right!"

"YANKEE" TOOLS

make good mechanics better

North Bros. Mfg. Co., Phila. 33, U. S. A.

Established 1880

Makers, also, of "Yankee-Handyman" Tools



Refusing smokes and chocolate bars,
Trading batteries from the tars,
This chieftan made them wonder why,
But now they see he's a clever guy.



You can't buy them as before
When it's over there'll be more



Before 400 B.C. the Spartans used gas, melting pitch, charcoal and sulfur and allowing the wind to blow its fumes onto the enemy. Some similar composition was used to "gas" at least one city in our Civil War.

And, as with every effective weapon, fire and gas have been decried as "horrible" and "inhumane." It is a lamentable truth that if they were not, they would not be effective. In the 12th century, efforts were made to outlaw the crossbow; gunpowder later was called the enemy of chivalry. Fire and gas weapons bring like criticism.

Men of the Chemical Warfare Service gravely doubt the enemy has any secret gas; by studying the destination of raw materials, chemists feel they can determine what the enemy is up to. If he hasn't used gas yet, it may be because he has not found gas to his advantage—or because he fears the consequences. A view of our preparations, and of the skill of such officers and men as those at Edgewood, shows the enemy has reason to be afraid.

Spy Trap

(Continued from page 5)

alone with a package of cigarettes to think it over. That sort of a primer usually starts the truth flowing.

Vigilant citizens have been effective "listening posts" in the FBI fight against saboteurs and spies. Last year the people sent in 282,000 tips of suspicious incidents, and of course many thousands proved harmless. One "spy" seen watching a war plant through a telescope turned out to be an 18 year old lovelorn youth trying to spot his girl friend in the factory. Nevertheless, the alertness of the citizenry has brought many a dangerous Nazi into custody.

The curiosity of a New England aerial photographer brought about the capture of the mysterious "Heinrich," the last missing and unidentified figure in the Duquesne spy ring. When Edmund C. Heine ordered 250 aerial photographs from him, the cameraman became suspicious and notified the FBI of the large order. They sprang the trap, found Heine was the "Heinrich" who had been furnishing the spy ring with intimate details of our aircraft production.

At this moment there is reason to believe that a new group of saboteurs is being trained at the German high command's special school, and that some of them will attempt to enter the United States.

Keep your eyes and ears open. Don't tattle on your neighbor just because he has a German name or because you don't like him. But if you have grounds for suspi-

(Continued to page 162)



A thousand letters

WHICH BREAK OUR HEARTS

LETTERS!

—THE PILE IS GROWING—

—letters from Privates, Corporals, Colonels, Generals, Seamen and Admirals—from Wacs, Waves, Spars . . . from everybody . . . everywhere.

Their urgent pleas strike a universal note . . . they say in effect:

I know of only one portable radio that will do the work out here—they say, writing from Africa and Alaska . . . from Australia and the South Seas . . . from all over the globe—Only one . . . and that is your Zenith Transoceanic Short Wave Portable Clipper. My folks tell me they have tried everywhere to obtain one with no success. Can you help me?

...so these letters come to us.

To each request must go the answer "No"—an unwilling "No"—and our regrets that this must be so. We were over 100,000 sets oversold on this one model when we ceased civilian

production for 100% war work.

Nothing would please us better than to have a great plenty of these justly famous portables to ship to all who need them—especially at this Christmas season—when our thoughts turn to loved ones everywhere. For our Transoceanic Portable Clipper is a real friend to the men and women in the service. Those who managed to get them early feel themselves fortunate; they are the envy of their friends!

BUT THESE PORTABLES MUST WAIT. The entire Zenith organization is now engaged in giving all its efforts to the making of tremendous quantities of urgently needed radionics* materiel for the armed forces. These things must come first—even ahead of the tender link with home which a personal radio provides for the fighting man far from friends and family. Thus we help to speed the day of "absolute Victory"—help to bring closer the next real American Christmas . . . with "Peace on Earth—Good Will to Men" . . . when families shall be reunited—and when home life can once again resume the even tenor of its ways.



ZENITH

LONG DISTANCE RADIO

ZENITH RADIO CORPORATION

CHICAGO 39, ILLINOIS

RADIONIC PRODUCTS EXCLUSIVELY—
WORLD'S LEADING MANUFACTURER



***RADIONICS** —with its subdivisions of Electronics, Radio, etc.



Dear Jack:

I shot this Indian

while it was getting the works here on the proving grounds. It's an experimental service test model -- a shaft-drive job that's a honey, like all Indian Motorcycles.

The boys who put these machines through their paces tell me they get a real feeling of safety out of the easy way an Indian handles and its ability to stand up under really tough going.

When the war's over, Indian's going to have a motorcycle that'll make your eyes pop. After what I've seen here, I'm going to ride one, believe me!

INDIAN MOTORCYCLE COMPANY, SPRINGFIELD, MASS.



★ ★ TO BUY AN INDIAN LATER ★ ★

cions, if you sincerely believe that he is a menace to America, call the nearest Field Office of the Federal Bureau of Investigation, which number can be found on the front page of your telephone directory. If it is a matter of extreme importance, call Washington—National 7117. The FBI is ready to listen and to act.

Giant of the North

(Continued from page 11)

"penstocks" or separate halves which turned away from each other and formed a "Y." The ends of the "Y" led into turbo-generators so that two of these whirling machines shared the huge downrushing column of water.

Before the flow could be started, however, it was necessary to blast the plug of the tailrace, or channel, dug from the powerhouse to the bed of the river so the torrent could continue its flow downstream.

A network of holes and tunnels was dug into the rock barrier which cut the tailrace off from the river bed. About fifty tons of the most powerful dynamite were planted in this plug which consisted of about 18,000 cubic yards of solid rock.

At a given signal the tremendous charge was set off and huge masses of rock hurtled through the air, some damaging the forms of the still unfinished powerhouse. Some said they felt the shock 50 miles away.

The blasting of the tailrace roughly completed outlines of the huge project and the turbogenerators were put to work in pairs as fast as they were completed. Before the first pair of waterwheels was whirling, linemen had braved 30 and 40 degree below zero temperatures and buffeting winds to mount high in the air to string cables and conduits to carry the current to the aluminum plant downstream.

Until current began to flow from Shipshaw, a small aluminum plant was operated by a smaller hydro-electric development. In preparation for the tremendous power from the new giant of the north woods, the aluminum plant had been greatly enlarged.

Month by month, as sections of the big development upstream came into action, the production was stepped up and aluminum ingots flowed into airplane factories in an increasing stream.

Many of the exploits of English, Canadian and American planes which have filled the newspapers would have been impossible except for the power supplied by the gigantic secret plant set up in the wilderness of snow and ice. Except for Shipshaw, the aluminum would not have been available to construct the planes.

*"Good Pictures"
bring you
together*



Corporal Paul Klages, United States Army Air Force, one of the many employees of International Industries whose now in the armed services whose wife is continuing with the company on the job of building vital war material.



Dear Mayzo: I've seen a lot of the world since I last talked with you, but none of it looks as good as home . . . those pictures you sent look mighty good to me . . .

Make the most of your present camera! Take good care of it, and conserve vital film by making each picture a good picture. After Victory Argus will make new cameras . . . employing the new techniques and extensive experience acquired in War Production.



AWARDED TO PLANT 2
OPTICAL DIVISION

"Good Pictures"

Make the best use of your present equipment — learn more about lenses — films, filters and composition. Send 25c today for this 56-page booklet. Write Dept. S.

FINE AMERICAN CAMERAS
PRECISION OPTICAL INSTRUMENTS
AVIATION RADIO EQUIPMENT
BUY WAR BONDS

argus
INTERNATIONAL INDUSTRIES, INC.

ANN ARBOR MICHIGAN

Please use CASCO GLUE for essential repairs only



One of hundreds of ways glue is going to war. Photo shows three of 500 giant CASCO-glued laminated wood beams built to Navy Specifications by Attwell Const. Co., Glue Fabricators, Seattle, Washington.

● Good industrial glues like CASCO and CASCAMITE are scarce. Uncle Sam needs them for jobs like those 5,000-lb. beams shown above—and for aircraft, life rafts, boats, plywood and all kinds of field equipment.

So use these glues only to repair your furniture, screens and necessary home equipment.

Today it's *fight*. Plenty of time and plenty of glue for *fun*—tomorrow.



CASCAMITE Resin Glue for waterproof gluing. CASCO Casein Glue for water-resistant gluing. 10¢ and larger sizes at hardware stores.



FREE REPAIR GUIDE!

CASEIN COMPANY OF AMERICA, Dept. PM-1243
350 Madison Avenue, New York, N. Y.

Send me the literature checked.

☐ "GLUING GUIDE". Complete directions for both glues. Over 80 home workshop and repair jobs.

NAME _____

ADDRESS _____

----- Save 2¢ — Stick coupon on penny postcard -----

"Radio Heat" Dehydrates Foods Removing 99 Percent of Water

With radio-frequency energy, the moisture content in compressed vegetable blocks is reduced to one percent. Foods dehydrated by ordinary hot-air methods retain about five percent of moisture, involving danger of spoilage in the tropics. Tests indicate that vegetables dehydrated by the electronic method will not spoil in hot, humid climates over a period of one or two years. The "radio heat" is applied after 80 percent of the moisture is removed by conventional methods and the dried food compressed into blocks. Short-wave energy further reduces moisture content without toughening or blackening the vegetables, a condition caused by excessive treatment with hot air. The vitamin content of the foods subjected to electronic drying in a partial vacuum is said to be unusually high.

Fire-Fighting Unit on Flatcar Protects Shipments of Oil

To help insure the safety of war shipments, particularly oil, along the right of way where local water supplies are lacking, a fleet of fire-fighting cars has been developed by the New York Central Railroad. They will be stationed at points strategic to the movement of petroleum supplies to the east. Each car consists of a locomotive tank tender on one end of a flatcar, covered with a housing. The tank holds 8,000 gallons of water, pumped by a gasoline pump on the flatcar. The water may be applied as a spray, creating a blanket of steam to smother the flames, or mixed at the nozzle with a chemical that produces a foam.

Lacquer Made From Potatoes May Coat Postwar Car

Starch acetate, a compound made from potatoes, formic and acetic acid, may be applied as a lacquer to coat postwar automobiles and other products. The new lacquer, which has yet to advance from the laboratory to the factory stage, is a chemical relative to the cellulose acetate made from cotton and wood pulp and which is used to make rayon, plastics, lacquers and other products. Starch acetate will probably not be suitable for solid plastics because it is brittle. It can be used to make water-resistant adhesives, cements and binders as well as lacquers.

Warplanes spend scarcely more than three percent of their time in the air.

Dr. Lee P. Smith & Dr. G. H. R.
Readway,
H. S. Dept. of Agriculture, Eastern
Regional Research Lab., Phila., Pa.

POPULAR MECHANICS

**THERE'S
BEEN
A
BIG
CHANGE**



Things are different now. Dress is more practical, machines more efficient, transportation dependable. Much good has come from change.

There's been a change—a striking improvement—in tapered roller bearings, as well. Tyson took the old-time conventional bearing, and found the way to *add an aver-*

age of 30% more rollers around the raceway!

Think of it! More rollers—more load-carrying capacity. More rollers—longer bearing life. More rollers—a better bearing. You have only to ask those who have given Tyson "All-Rolls" Bearings a thorough workout under the most trying conditions. *The big name in bearings today is . . . TYSON!*



TYSON BEARING CORPORATION, MASSILLON, OHIO

COUNT THE ROLLS • THE ROLLS COUNT

Tyson
TODAY'S HEAVY-DUTY BEARING



★ BUY MORE WAR BONDS ★

For Men Who

Really Know Pipes

Royalton

It's "that little more" that brings success in life. So with pipes. A Royalton adds that extra something to make a good tobacco taste better. Because this greater satisfaction brings enduring pleasure, a knowing smoker and his Royalton are seldom parted.

Gift suggestion: give him a Royalton Silver Crown . . . Write for booklet PM showing Silver Crown Models.



**Royalton
CLUBMAN**



ROYALTON \$5
Silver Crown
Choice Grains

Wherever Better Pipes are Sold

HENRY LEONARD & THOMAS, INC., OZONE PK., N. Y.

Paint Recovered From the Air Eases Shortage of Primers

Thanks to an experiment a decade ago with a \$12 cider press, millions of gallons of scarce paints are now recovered almost literally "from the air." An engineer of the Plymouth Division of Chrysler Corporation developed the process. In spray-gun painting, the tiny particles of paint that charge the atmosphere of the paint booth are carried away by a continuous water curtain. But the engineer, curious about the possibility of reclaiming the paint thus floated away, subjected the spray-laden water to the cider press, and "squeezed" the water out. The resulting product, to which a thinner was added, was so similar to new paint that experts in the laboratory, asked to test it, demanded: "What's the complaint?" Such reclaimed paint is now obtained by the drum at the Plymouth reclaiming plant. Often the reclaimed materials are made from extremely scarce raw materials, so the paint reclamation process becomes of immense importance to the war effort.

Automatic Gear Shift for Tanks Increases Speed of the M-5

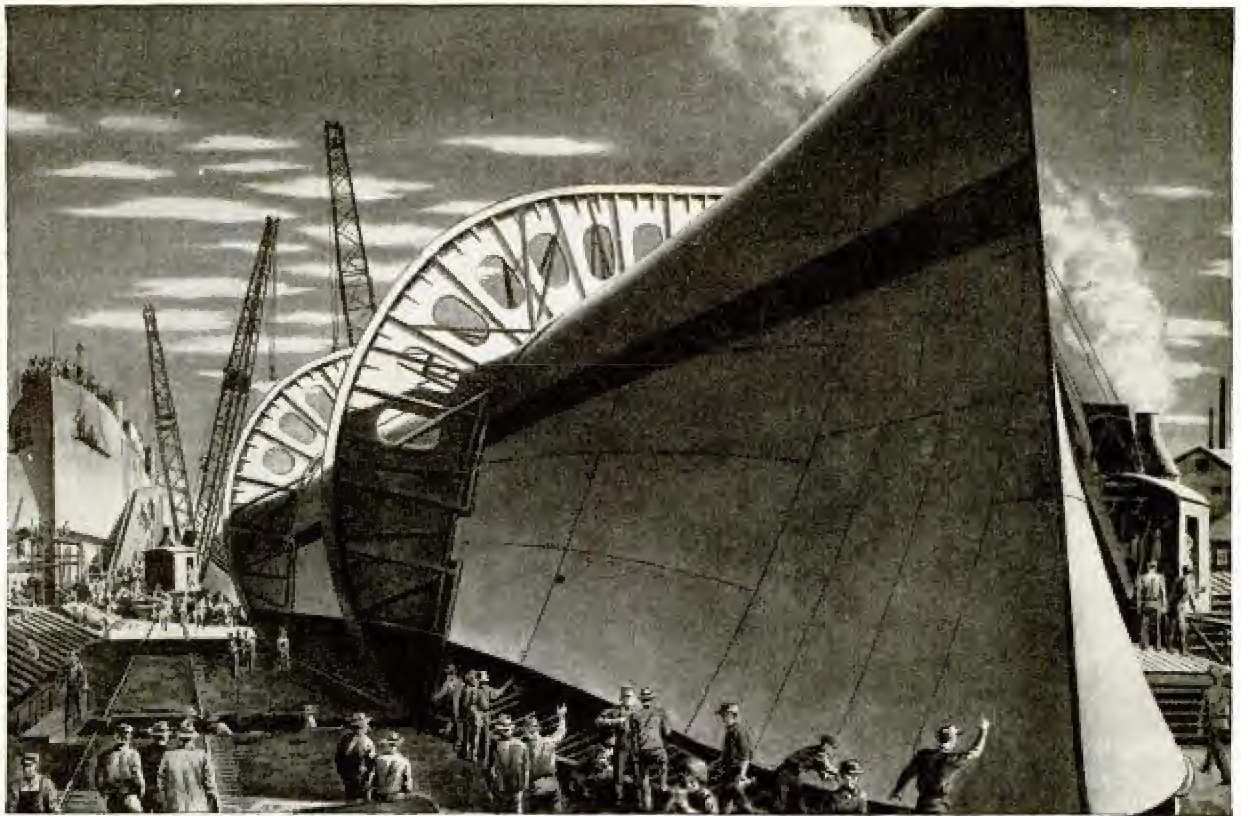
Greater speed and maneuverability of lightweight M-5 tanks used in the invasion of Africa are due to an automatic gear shift similar to that used in automobiles. The shift, never before used in a military vehicle, enables the tanks to operate at sustained speeds without slowing down to shift gears. It also gives the driver more time to concentrate on tactics during combat. The engines and transmission systems for the M-5 were developed by General Motors Corporation and are almost identical with those used in Cadillac automobiles.

Safest Child Is Louisiana Girl Five to 14 Years of Age

If you're a girl between the ages of five and 14 years and live in Louisiana, you're the safest person in the United States. Statistics in "Accident Facts," yearbook of the National Safety Council, prove it. Louisiana was ranked the safest state last year in all types of accidents, and figures show that the age group between five and 14 has the lowest accident rate. Furthermore, girls are hurt less often than boys.

*To Mr. Wacker, Dr.
Chicago, Ill.*

ⓈThe fire power of a P-40 Warhawk at normal speed with all guns firing has been compared with a 13-ton tank hitting a brick wall at more than 30 miles an hour.



How Defoe Turns Things Upside Down

TO DOUBLE PRODUCTION OF WARSHIPS!

WITH record-breaking frequency, these days, flashing axes bite through stay-hawsers on the launching ways of the Defoe Shipbuilding Company at Bay City, Michigan . . . sending another and another destroyer escort ship for the Navy sliding down to blue water.

These are the famous DE fighting ships whose terrific execution among the U-boat wolf packs has helped bring the submarine menace under control.

Welded into one 750-ton piece of steel, more than 300 feet in length, the sturdy hard-hitting DE type ships are built upside down and then "rolled over" in their cradles to complete their equipment. This unique Defoe method of building ocean-going ships, eliminates the need of conventional ship scaffolding and by enabling workers to stand *over* the job from

beginning to end gives remarkable advantages in saving time and labor costs. Among results obtained by Defoe engineering methods is the *doubling of production per man hour—with twice as many ships being built at half the labor cost per vessel!*

Until the Axis is defeated, the full facilities of the Defoe organization will be concentrated exclusively on all-out production for Victory.

But tomorrow, when Peace is restored, the experience and improved techniques learned in war work will be used to create new high standards of quality, value and economy in finer products for the consumers of America.

★ ★ ★

BACK THE ATTACK—BUY WAR BONDS
Defoe workers take more than 10% of their pay in War Bonds

"Next to our immediate task of building warships faster and faster, the first responsibility of Defoe is to plan for post-war operation that will provide the maximum of gainful employment."

HARRY J. DEFOE
Founder Defoe Shipbuilding Co.

DEFOE SHIPBUILDING COMPANY, BAY CITY, MICHIGAN

Defoe



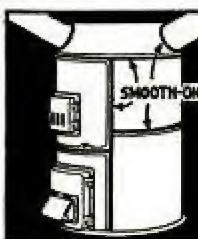
Three White Star Renewal Citations now decorate the Navy "E" Award won by Defoe workers.

Ships for Victory
Servants for Peace

Tackle those Repairs Yourself...



with handy SMOOTH-ON



Those boiler leaks, cracked pipes, loosened joints, fixtures, handles, bolts, screws, can all be remedied promptly, inexpensively, securely—without having to wait your turn for a busy mechanic or repairman. Just get yourself a can of SMOOTH-ON No. 1—the handy iron cement, and tackle the job yourself. No previous experience necessary. No heat. No difficult processes to learn—just follow simple directions. Smooth-On is always dependable, makes durable repairs. Popular with mechanics, plumbers, repairmen since 1895.

You'll find any number of convenient uses for Smooth-On in home, garage, shop. Little jobs and big ones. From tightening loose tool handles, casters, drawer pulls, to repairing cracks and leaks in pipes, tanks, radiators, auto cylinders, crank and gear cases, etc.

Get This 40-Page FREE BOOK

Shows you how to save time and money and get repairs done right when you need them most. Easily followed directions. 170 diagrams. Handy index. Fits the pocket. Yours for the asking—just mail the coupon.

Buy SMOOTH-ON in 1 1/4-oz., 7-oz., or larger containers from your supply house or, if necessary, from us.



Free

Do it with SMOOTH-ON

-----SEND NOW-----

Smooth-On Mfg. Co., Dept. 37,
570 Communipaw Ave., Jersey City 4, N. J.
Please send MY copy of the Smooth-On Book.

Name.....

Address.....

12-43.....

"Sticky" Bombs Wear Mittens Coated With Adhesive



British war workers covering glass antitank bombs

Antitank "sticky" bombs, a secret weapon recently made public by British authorities, are made of glass globes encased in woolen mittens. The globes hold a powerful explosive and the mittens are soaked in a special adhesive. They are carried in a protective jacket which is removed when the bomb is thrown. The bomb sticks to the target and detonates in a few seconds.

Small Jap Sub Carries Freight Lashed to Open Deck

Unarmed cargo submarines are used by the Japs in the South Pacific to supply isolated troops, according to Col. Conrad H. Lanza. The undersea freighters are of 400-ton and 1,000-ton sizes, the smaller carrying about 40 tons of freight and the larger nearly 400 tons. Part of the freight is lashed to the decks of the subs.

Telegrams Sent by Light Wave May Replace Wire Service

Beaming telegrams by light waves may replace present-day wire transmission after the war, according to F. E. D'Humy, vice-president of Western Union Telegraph Company. The new device, called telefax, incorporates some of the principles of television and reproduces the original message prepared by the sender. Telefax would not only lower rates, but would reduce chances for error, Mr. D'Humy said.

*"Ridin' high, wide,
and handsome"*

in rubber boats
powered with Evinrudes!



On many fronts . . . in many ways . . . large, capacious rubber boats serve our Navy and Marine Corps. Before launching they are compact "packages", easily handled, stowed, transported. Quickly the hulls can be unfolded . . . swiftly their compartments are inflated to plump buoyancy . . . motors are secured on special stern brackets . . . and they're set to go!

In a brief period a fleet of them can be readied for duty. With load capacity of several tons, they are used for rearming and refueling operations at advance bases. In landing operations, such a boat carries eighteen men, battle equipped, through heavy surf and over coral reefs. Highly maneuverable and amazingly light in draft, they can be operated in shoalest waters. They are driven by powerful, full-reversing Evinrude "Lightfour"

motors specially developed for this service.

To meet the varied requirements of amphibious warfare on every front, Evinrude engineers have perfected numerous new developments and applications of outboard power, many of which have advanced the peacetime outboard motor into new fields of usefulness. Today these developments — and every motor we build — belong to America's armed forces. *After Victory* they will be yours...for your greater enjoyment of every hour on the water!

EVINRUDE MOTORS, Milwaukee 9, Wisconsin

Evinrude Motors of Canada, Peterboro, Canada



EVINRUDE
OUTBOARD MOTORS

★ ONLY FIGHTING DOLLARS COUNT . . . BUY MORE BONDS

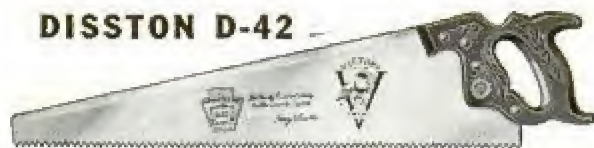


One of the most significant developments of war has been the extensive and remarkably successful use of the glider. When Victory is won this useful craft undoubtedly will play a most important part in peacetime transportation.

Glider builders are built rapidly and in volume by plants which specialize in this construction. Many of the tools used are made by Disston and include Disston hand saws, back saws, dovetail saws, compass saws, coping saws, circular saws, band saws, hack saws, files, mitre squares, bevels, gauges, levels, cabinet scrapers and others.

When you require tools for *essential* purposes, see your Hardware Dealer, and ask about tools by Disston. Here is the finest hand saw in the Disston line:

DISSTON D-42



Victory-lightweight Straight-back pattern. Made in 26-inch 7, 8, 10, and 11 points cross-cut, 5½ points rip.

MAKE TOOLS LAST with the help of the Disston Saw, Tool and File Manual—FREE from your Hardware Dealer, or write for your copy.



HENRY DISSTON & SONS, INC.
1211 Tacony, Philadelphia 35, Pa., U. S. A.

Bullet's Caliber and Metric Size Easily Translated to Inches

Both the designations "caliber" and "millimeter" refer to the size of the bore of a machine gun or cannon, and thus to the size of the bullet it can shoot. A millimeter, one thousandth of a meter, is equal to 0.03937 of an American inch. Thus, a 20-mm. bullet is a little over seven-tenths of an inch thick at its base. Not the base of the shell, which is ejected at the breech of the gun, but the bullet itself provides the measurement. Caliber is designated in terms of inches. A .22 caliber, for example, is just over two-tenths of an inch thick at the base of the bullet. The .50-caliber bullet measures five-tenths, or half an inch.

Food Yeast Grown in a Day Augments Diet of Allies

Limited quantities of food yeast, or nutritional yeast, are being shipped to United Nations nationals to augment diets too frequently lacking in proteins. Source of the yeast may be cultures fed by molasses and ammonium sulphate or brewers' yeast, with the taste of beer removed. Full-grown food yeast contains 45 percent protein, and is high in vitamin-B content. One and one-half ounces of yeast are equivalent to two eggs in protein content, and half an ounce can supply the daily B-complex requirements of the normal diet. Annual production of food yeast, about 4,000,000 pounds, is to be increased for the benefit of our allies, and liberated nations. Nutritional yeast can be grown in 24 hours.

Fence Post Becomes Gun Mount By Use of Scrap Metal Base

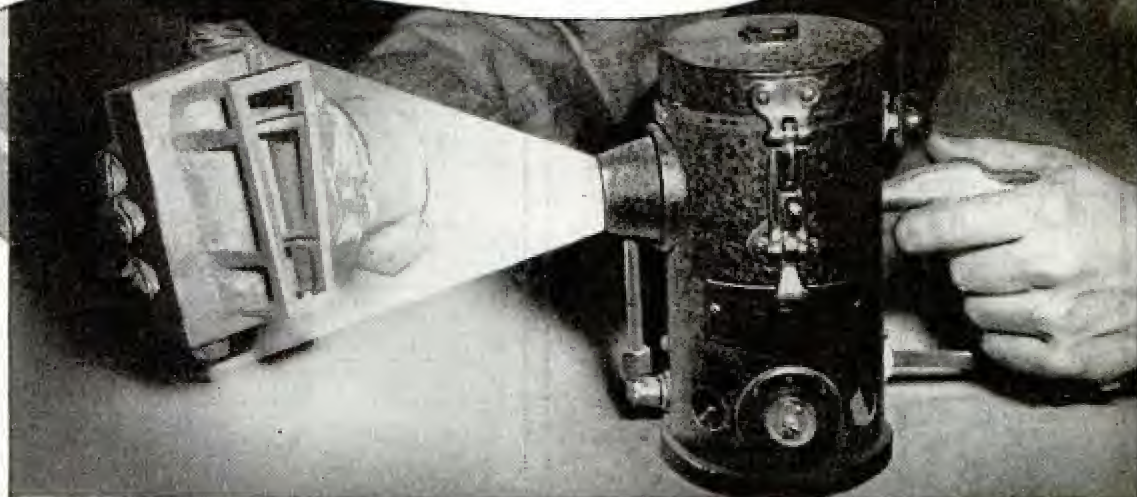
Fence posts, tree stumps—indeed, any piece of timber from three inches to two feet in diameter—may be used as an anti-aircraft mount for the .50-caliber machine gun by use of a home-made device utilizing scrap metal. Basis of the mount, described in the "Field Artillery Journal," is a one-foot piece of four-inch angle iron. Two pieces of chain are attached near either end in such a way that they can be snugged up tight by turning a pair of wing nuts. These clamp the device to the wooden mount. Across one end of the angle iron is welded a circular plate, grooved to receive a flange projecting from a second, freely rotating plate. The two are pivoted on a bolt passing through their centers. On top of the second plate are welded a pair of forked arms, serving as supports for the gun. Only 18 inches long and weighing 25 pounds, the mount is readily transported.

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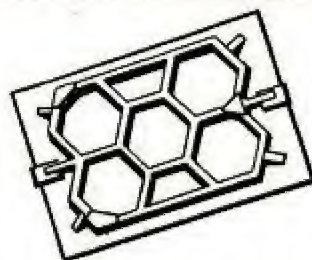
Molten metal sprayed on wood foundry patterns by a compressed air gun provides a protective coating against sand wear on the finished surfaces, thereby prolonging the life of the pattern and eliminating costly repairs.

The metal may be sprayed directly on the untreated wood surface of the pattern or core box. If the wood surfaces are hard or close-grained, a shellac primer is first applied, the metal being sprayed on before the shellac dries. The thickness of the metal coating is about 5 thousandths of an inch.

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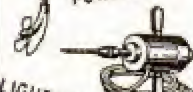
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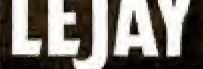
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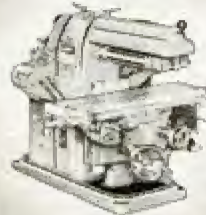
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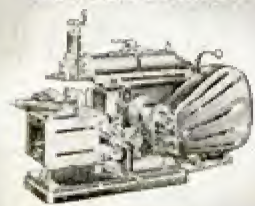
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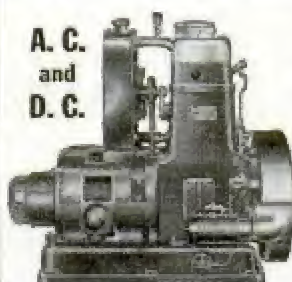
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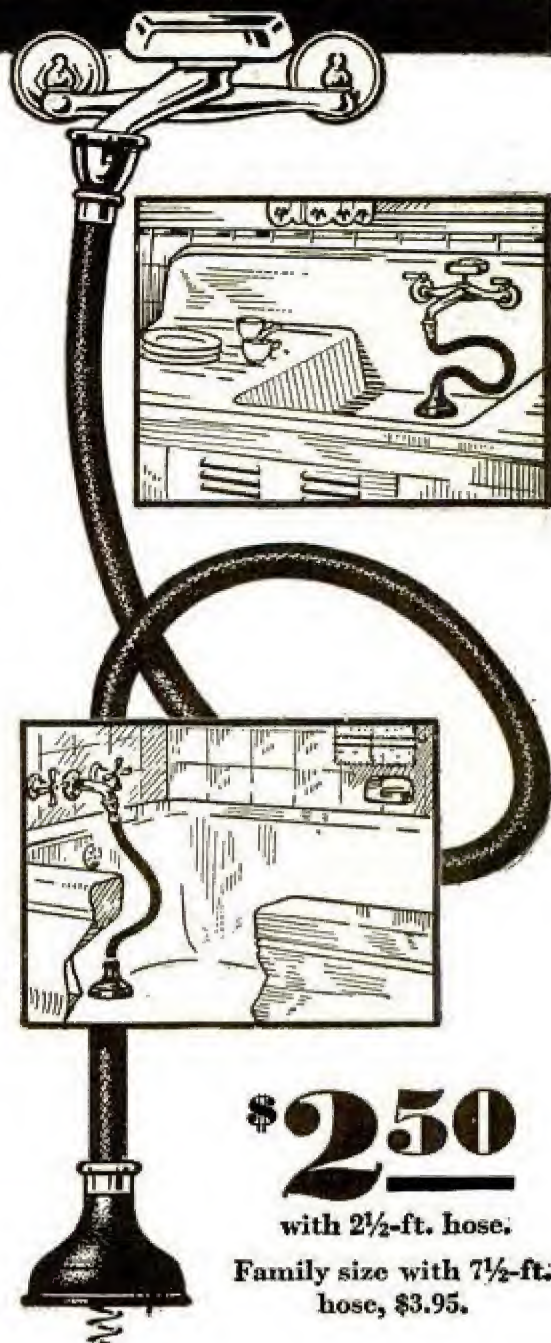
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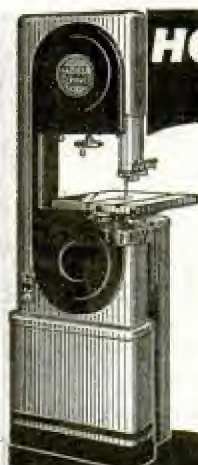
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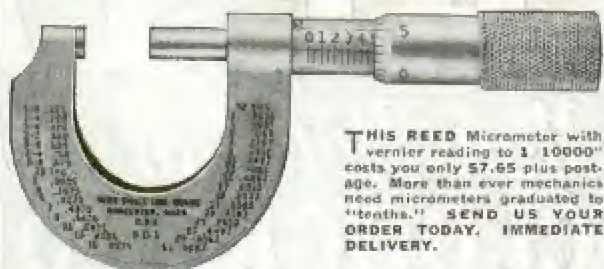
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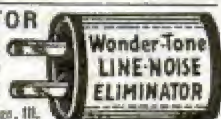
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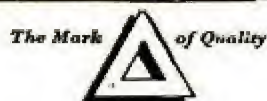
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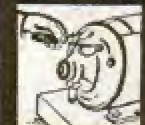
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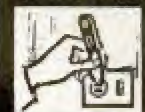
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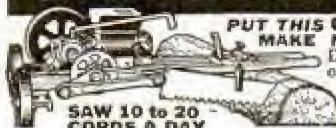
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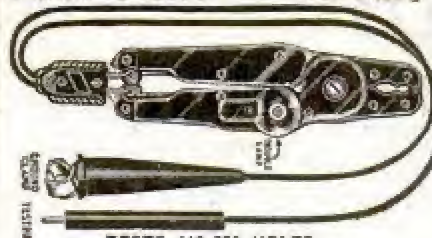
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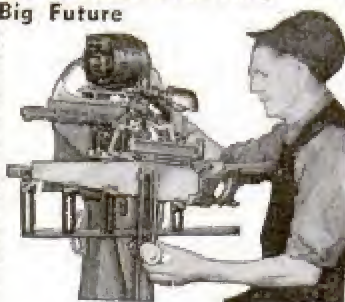
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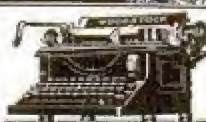
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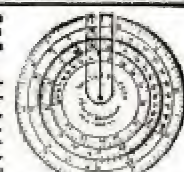
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